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Issued by the Discovery Committee
Colonial Office, London
on behalf of the Government of the Dependencies
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CAMBRIDGE
AT THE UNIVERSITY PRESS
1943

PRINTED IN GREAT BRITAIN BY WALTER LEWIS, M.A., AT THE UNIVERSITY PRESS, CAMBRIDGE

CONTENTS

STATION LIST, 1933–1935 (published 13th April, 1942)

Introduction . . . . . page 3
R.R.S. 'Discovery II', Stations 1185–1589 6
Summarized list of stations 196
Plates I–IV . . . . . following page 196

THE SOUTHERN STOCKS OF WHALEBONE WHALES (published 10th June, 1942)
By N. A. Mackintosh, D.Sc.

Introduction . . . . . page 199
Species of whalebone whales 201
Food in the Antarctic and in warmer waters 209
Parasites and diseases 213
Breeding, growth and age 216
Statistics of catches 227
Migrations and distribution 236
Relative abundance of the different species 260
Sex ratio 266
Seasonal changes in the local composition of the stock 269
The stock of whales 278
Summary 293
Appendix. Common names of whalebone whales 297
References 298

POLYZOA (BRYOZOA). I. SCRUPOCELLARIIDAE, EPISTOMIIDAE, FARCIMINARIIDAE, BICELLARIELLIDAE, AETEIDAE, SCRUPARIIDAE (published 29th September, 1943)
By Anna B. Hastings, M.A., Ph.D. British Museum (Natural History)

Introduction . . . . . page 303
List of stations, and of the species collected at each 305
List of species discussed 318
Systematic descriptions 319
Geographical distribution of species 477
The relation between hydrological conditions and the distribution of the species . 491
Geographical distribution of genera 492
Seasonal distribution of ancestrulae 497
Note on the vermiform bodies found in some Polyzoa 499
Addendum 501
References 501
Index 506
Plates V–XIII . . . . . following page 510

[*Discovery Reports. Vol. XXII, pp.* 1–196, *Plates I–IV, March,* 1942.]

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DISCOVERY INVESTIGATIONS
STATION LIST

1933–1935

CONTENTS

INTRODUCTION . . . . *page* 3

R.R.S. ‘DISCOVERY II’, STATIONS 1185–1589 6

SUMMARIZED LIST OF STATIONS 196

PLATES I–IV . . . . *following page* 196

DISCOVERY INVESTIGATIONS
STATION LIST

1933–1935

(Plates I–IV)

INTRODUCTION

This list is a continuation of the Station Lists already published in *Discovery Reports*, vols. I, III, IV and XXI and it gives particulars of observations made by the R.R.S. 'Discovery II' from November 1933 to May 1935. It is drawn up on the same lines as the Station List in vol. XXI published in February 1941. There is, however, one important difference: no pH values are given, because, although colorimetric determinations were made at most stations, it was not possible, owing to difficulties of replacement, to make any reliable correction for the fading of the standard buffer-tubes; consequently the figures are likely to be of only limited value and have not been printed.

Between stations 1435 and 1459 inclusive, a defective Ekman reversing water sample bottle was apparently in use at some stations for some depths. During hauling to the surface, admixture of other sea water occurred to the sea water sample in the Ekman reversing water bottle. This was clearly evidenced by the salinity titrations which usually showed that a dilution had occurred. The depths at which this particular water sample bottle was in use are shown in italics and the chemical data belonging to these depths are suspect and have been marked with a query to show this. Interpolation for salinity has been made and this is shown by the use of brackets enclosing the salinity and σt values.

In order to specify the depths at which sea water samples were obtained at each hoist of reversing water sample bottles, a small index figure has been placed above the figures in the column headed "Depth (metres)". The samples from depths bearing the *same* index figure were obtained from the *same* hoist of water sample bottles. With this knowledge and the readings given by the unprotected thermometers, it has been possible to interpolate and give probable values of depth to each reversing water bottle.

Time is again expressed on the 24-hour system, the day ending with midnight (0000). The difference of the ship's time from Greenwich mean time (GMT) is noted in the "Remarks" column, this difference holding good until another entry is made. To convert ship's time to GMT, the figure in the "Remarks" column is to be added or subtracted according to sign. Times in heavy type refer to biological observations made between sunset and sunrise.

Abbreviations for nets, etc., used during 1933–5 are as follows:

B	Oblique.
BNR	Russell's bottom tow-net. A 100 cm. net on a frame attached to skids which raise it clear of the bottom.
DGP	Pressure depth gauge: a modification of the Budenberg pattern.

DLH	Large dredge. Heavy pattern, 4 ft. in length (1·2 m.).
CWS	Centrifuged water sample.
H	Horizontal.
KT	Kelvin tube.
LH	Hand lines.
NH	Hand net.
NHP	A modification of Harvey's phytoplankton net.[1] A metal funnel (aperture 30·5 cm.) leads to a recording mechanism and thence to a sleeve-shaped silk net of 200 meshes to the linear inch, terminating in a conical bucket. The apparatus is hauled vertically, and the mechanism records the approximate volume of water filtered.
N 50	50 cm. tow-net. Mouth circular, 50 cm. in diameter (19·5 in.): 200 meshes to the linear inch.
N 70	70 cm. tow-net. Mouth circular, 70 cm. in diameter (27·5 in.): mesh graded, at cod-end 74 to the linear inch.
N 100	1 m. tow-net. Mouth circular, 1 m. in diameter (3·3 ft.): mesh graded, at cod-end of stramin with 10–12 meshes to the linear inch.
N 450	4½ m. tow-net. Mouth circular, 4½ m. in diameter (14·8 ft.): mesh graded, cod-end of 7 mm. (0·28 in.) netting, lined for part of its length with 4 mm. (0·16 in.) netting.
NRL	Large rectangular net. Frame 8 ft. long and 2¼ ft. wide (2·45 m. × 0·7 m.) with bag of ½ in. mesh (12·5 mm.).
Sh. Coll.	Shore collecting.
TYF	Young-fish trawl. A bag of stramin, with 10–12 meshes to the linear inch, attached to a circular frame 2 m. in diameter (6·6 ft.).
V	Vertical.

To the symbols for tow-nets (N 450, N 100, N 70, N 50 and TYF) B, H or V is always added to indicate the direction in which the haul was taken. For determining the depths of horizontal and oblique nets, Kelvin tubes or depth gauges were constantly employed. Their use is indicated by symbols in the "Remarks" column, and where no such symbol appears it is to be understood that the depth was estimated.

For symbols used to denote meteorological observations, see Station List, 1931–33 (*Discovery Reports*, vol. XXI, p. 3).

Soundings taken by the echo-sounding apparatus are marked with an asterisk.

At the end of the lists (p. 196) will be found a summary of the stations made by the R.R.S. 'Discovery II' from November 1933 to May 1935, with reference to the charts on which the station positions are marked.

---

[1] See Harvey, H. W., 1934. *Measurement of Phytoplankton Population.* Journ. Mar. Biol. Assoc., N.S. XIX, pp. 761–73.

R.R.S. 'DISCOVERY II', STATIONS 1185-1589

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1185	31° 51·1′ S, 13° 36·6′ W	1933 14 xi	1530	2500*	SE × E	16	SE × E	3	omd	1023·6	17·7	15·6	mod. swell
1186	0·3 miles N 43° W from Black Cliff, Quest Bay, Tristan da Cunha	16 xi	0630	27*	Lt airs	1–2	—	1	bc	1020·3	17·0	11·5	low W swell
1187	From 2·2 miles to 0·8 miles S 65° E of South Hill, Inaccessible I, Tristan Group	18 xi	0823	135*	SSW	15	SW × S	4	bc	1021·6	13·3	9·7	mod. SSW swell
			0826	134*									
			0837	117*									
			0850	104*									
1188	41° 56′ S, 15° 08·6′ W	19–20 xi	2000	3160*	W × N	14	W × N	3	bc	1024·0	12·1	11·1	mod. WSW swell
			0105	—	W × N	10	W × N	3	o	1022·2	12·1	11·4	mod. W swell
1189	44° 05·1′ S, 18° 07′ W	20 xi	2000	3412*	NNE	6	NNE	2	or	1015·9	9·2	8·1	low WSW swell
1190	46° 17·1′ S, 21° 38·9′ W	21–22 xi	2000	4559*	W × S	16	W × S	4	or	1000·3	8·0	7·8	mod. conf. W swell
			0104	—	WSW	8	WSW	3	b	1002·3	6·2	4·8	mod. conf. W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.^{3}							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1185	27	0	—	17·45	35·57	25·86	—	—	—	—	—	**TYFB**	140–0	1718	**1808**	DGP. +2 hours
1186	28	0	—	14·70	—	—	—	—	—	—	—	**LH**	27	0630		
1187	1	0	—	14·00	35·20	26·36	—	—	—	—	—	**DLH**	135–134	0825	0828	
												,,	117–104	0842	0852	
1188	2	0	—	12·43	35·07	26·57	0·61	—	0·13	<5·0	6·05	**N 50 V**	100–0	**2010**		
		10	—	12·45	35·07	26·57	0·61	—	0·14	<5·0	—	**N 70 V**	50–0			
		20	—	12·45	35·07	26·57	0·61	—	0·15	<5·0	5·99	,,	100–50			
		30	—	12·43	35·07	26·57	0·61	—	0·15	<5·0	—	,,	250–100			
		40	—	12·40	35·07	26·58	0·59	—	0·16	<5·0	6·00	,,	500–250			
		50	—	12·37	35·07	26·59	0·57	—	0·16	<5·0	—	,,	750–500			
		60	—	12·36	35·07	26·59	0·57	—	0·14	<5·0	5·95	,,	1000–750	—	**2157**	
		80	—	12·35	35·07	26·59	0·59	—	0·15	<5·0	—	**NHP**	50–0	**2231**		
		100	—	11·92	35·07	26·67	0·68	—	0·31	<5·0	5·83	,,	100–0	—	**2255**	
		150	—	11·57	35·04	26·72	0·67	—	0·00	<5·0	5·61	**CWS**	0	**2258**		
		200	—	—	—	—	—	—	—	—	—	,,	5			
		300	—	9·62	34·76	26·84	1·18	—	0·00	<5·0	5·02	,,	10			
		400	—	7·75	34·54	26·97	1·71	—	0·03	12·7	5·12	,,	20			
		600^{1}	598	4·78	34·27	27·14	2·07	—	—	20·2	5·56	,,	50			
		800^{1}	—	3·68	34·22	27·21	2·24	—	—	32·9	5·54	,,	100	—	**2317**	
		1000^{1}	—	3·05	34·30	27·34	2·38	—	—	45·5	5·01	**N 70 B**	139–0	**0038**	**0058**	KT
		1500^{2}	1492	2·71	34·54	27·57	2·66	—	—	70·8	4·12	**N 100 B**				
		2000^{2}	2001	2·75	34·74	27·73	2·32	—	—	93·6	4·39					
		2500^{2}	—	2·58	34·81	27·80	2·07	—	—	81·0	4·53					
1189	3	0	—	8·07	34·23	26·68	1·24	—	0·22	0·0	6·72	**N 50 V**	100–0	**2013**		
		5	—	8·06	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	7·94	34·26	26·72	1·27	—	0·22	0·0	—	,,	100–50			
		20	—	7·82	34·26	26·74	1·22	—	0·22	0·0	6·72	,,	250–100			
		30	—	7·75	34·26	26·75	1·20	—	0·20	0·0	—	,,	500–250			
		40	—	7·73	34·26	26·75	1·25	—	0·21	0·0	6·68	,,	750–500			
		50	—	7·56	34·26	26·78	1·25	—	0·21	0·0	—	,,	1000–750	—	**2225**	
		60	—	7·11	34·28	26·86	—	—	0·24	0·0	6·67	**NHP**	50–0	**2145**		
		80	—	6·53	34·29	26·94	1·33	—	0·30	0·0	—	,,	100–0	—	**2210**	
		100	—	6·31	34·29	26·97	1·35	—	0·34	0·0	6·62	**CWS**	0	**2230**		
		150	—	6·03	34·28	27·01	1·41	—	0·03	0·0	6·50	,,	5			
		200	—	5·64	34·26	27·03	1·58	—	0·00	0·0	6·38	,,	10			
		300	—	4·33	34·22	27·14	—	—	0·00	16·5	5·97	,,	20			
		400	—	3·73	34·20	27·20	1·90	—	0·00	27·8	6·01	,,	50			
		600^{1}	617	3·06	34·19	27·26	2·26	—	0·00	36·7	5·79	,,	100	—	**2250**	
		800^{1}	797	2·65	34·25	27·34	2·51	—	—	48·1	5·17	**N 70 B**	115–0	**2301**	**2321**	KT
		1000^{1}	—	2·58	34·38	27·45	2·59	—	—	74·6	4·62	**N 100 B**				
		1450^{2}	—	2·59	34·62	27·65	2·59	—	—	81·0	4·26					
		1930^{2}	1930	2·61	34·78	27·77	2·41	—	—	87·3	4·53					
		2420^{2}	—	2·35	34·81	27·82	2·07	—	—	89·8	4·69					
		2900^{2}	2901	1·65	34·79	27·85	2·34	—	—	111·3	4·82					
1190	4	0	—	7·36	34·27	26·82	1·10	—	0·19	0·0	6·76	**N 50 V**	100–0	**2027**	—	+3 hours
		5	—	7·36	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	7·36	34·27	26·82	1·10	—	0·19	0·0	—	,,	100–50			
		20	—	7·36	34·28	26·83	1·08	—	0·19	0·0	6·77	,,	250–100			
		30	—	7·36	34·33	26·85	1·08	—	0·18	0·0	—	,,	500–250			
		40	—	7·36	34·34	26·87	0·95	—	0·18	0·0	6·72	,,	750–500			
		50	—	7·30	34·34	26·88	0·97	—	0·19	0·0	—	,,	1000–750	—	**2212**	
		60	—	7·12	34·34	26·91	1·05	—	0·19	0·0	6·68	**NHP**	50–0	**2140**		
		80	—	6·32	34·32	27·00	1·10	—	0·21	0·0	—	,,	100–0	—	**2157**	
		100	—	5·85	34·24	27·00	1·41	—	0·20	0·0	6·62	**CWS**	0	**2215**		
		150	—	5·17	34·23	27·07	1·41	—	0·09	0·0	6·54	,,	5			
		200	—	4·71	34·22	27·10	1·73	—	0·00	14·0	6·24	,,	10			
		300	—	3·95	34·19	27·18	1·90	—	0·00	19·2	6·11	,,	20			
		400	—	3·43	34·16	27·20	1·82	—	0·00	25·0	6·09	,,	50			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1190 *cont.*	46° 17·1 S, 21° 38·9 W	1933 21–22 xi											
1191	47° 08·6′ S, 23° 15·1′ W	22 xi	1002	4438*	NNW	20	NNW	4	bc	996·6	7·5	6·2	mod. NNW swell
1192	46° 50′ S, 23° 06·2′ W	22 xi	1656	4402*	NW × W	23	NW × W	6	c	993·5	6·2	5·0	mod. NW × W swell
1193	46° 33·3′ S, 23° 09·4′ W	22–23 xi	2210	4495*	W × N	23	WNW	4	bc	1000·0	6·4	5·0	mod. WNW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1190 *cont.*	4	600^1	597	2·74	34·22	27·30	2·13	—	—	41·9	5·47	**CWS**	100	—	**2231**	
		800^1	—	2·66	34·33	27·40	2·38	—	—	54·5	4·77	**N 70 B**	119–0	**0044**	**0104**	KT
		1000^1	—	2·62	34·48	27·53	2·43	—	—	55·5	4·27	**N 100 B**				
		1500^1	1500	2·63	34·70	27·71	2·28	—	—	60·0	4·10					
		1990^2	2000	2·52	34·78	27·78	2·13	—	—	67·1	4·32					
		2490^2	—	1·89	34·76	27·81	2·17	—	—	79·4	4·48					
		2980^2	2972	1·26	34·75	27·85	2·28	—	—	87·2	4·56					
		3480^2	—	0·71	34·71	27·86	2·36	—	—	107·0	4·57					
		3980^2	3989	0·19	34·69	27·86	2·41	—	—	111·9	4·82					
1191	5	0	—	4·97	33·97	26·89	1·37	—	0·24	—	7·33	**N 50 V**	100–0	1236		
		5	—	4·97	—	—	—	—	—	—	—	**NHP**	50–0			
		10	—	4·96	33·97	26·89	1·37	—	0·24	—	—	,,	100–50	—	1247	
		20	—	4·94	33·97	26·89	1·39	—	0·24	—	7·33					
		30	—	4·91	33·97	26·89	1·58	—	0·24							
		40	—	4·85	33·97	26·90	1·37	—	0·24	—	7·32					
		50	—	4·66	33·98	26·93	1·43	—	0·24							
		60	—	4·55	33·98	26·94	1·43	—	0·24	—	7·24					
		80	—	4·00	33·99	27·01	1·67	—	0·26							
		100	—	3·59	34·00	27·05	1·69	—	0·28	—	7·10					
		125	—	3·45												
		150	—	3·23	34·03	27·12	1·73	—	0·20	—	6·94					
		175	—	3·33												
		200	—	3·32	34·07	27·14	1·77	—	0·00	—	6·49					
		300	—	2·86	34·15	27·25	2·15	—	0·00	—	6·00					
		400	—	2·53	34·21	27·32	2·32	—	0·00	—	5·57					
		500	—	2·42	34·23	27·35	2·45	—	—	—	5·13					
		600^1	593	2·37	34·34	27·44	2·55	—	—	—	4·61					
		700^1	—	2·38	34·42	27·49	2·64	—	—	—	4·15					
		800^1	798	2·39	34·47	27·54	2·62	—	—	—	4·15					
		900^1	—	2·41	34·53	27·59	2·59	—	—	—	4·17					
		1000^1	1000	2·42	34·56	27·60	2·47	—	—	—	4·01					
1192	5	0	—	5·24	33·97	26·86	1·50	—	0·24	—	7·41	**N 50 V**	100–0	1707		
		10	—	5·24	33·97	26·86	1·50	—	0·24	—	—	**N 70 V**	50–0			
		20	—	5·24	33·97	26·86	1·46	—	0·24	—	7·42	,,	100–50			
		30	—	5·23	33·97	26·86	1·48	—	0·24	—	—	,,	250–100			
		40	—	5·11	33·97	26·87	1·48	—	0·24	—	7·39	,,	500–250	—	**1752**	
		50	—	4·54	33·97	26·94	1·67	—	0·24							
		60	—	4·03	33·98	27·00	1·79	—	0·24	—	7·21					
		80	—	3·94	34·04	27·05	1·75	—	0·24							
		100	—	3·69	34·05	27·08	1·77	—	0·25	—	7·04					
		150	—	3·44	34·12	27·17	2·07	—	0·00	—	6·65					
		200	—	3·47	34·14	27·18	2·20	—	0·00	—	6·31					
		300	—	2·98	34·15	27·24	2·20	—	0·00	—	6·05					
		400	—	2·66	34·20	27·30	2·41	—	0·00	—	5·55					
		500	—	2·41	34·23	27·35	2·57	—	—	—	5·22					
		590^1	606	2·33	34·32	27·42	2·70	—	—	—	4·77					
		690^1	—	2·34	34·37	27·46	2·74	—	—	—	4·52					
		790^1	772	2·33	34·42	27·49	2·87	—	—	—	4·28					
		890^1	—	2·42	34·51	27·57	2·79	—	—	—	4·01					
		980^1	985	2·45	34·56	27·60	2·79	—	—	—	4·08					
1193	5	0	—	5·09	34·01	26·90	1·48	—	0·23	—	7·28	**N 70 B**	87–0	**0134**	**0154**	
		10	—	5·10	34·01	26·90	1·52	—	0·22	—	—	**N 100 B**				
		20	—	5·10	34·01	26·90	1·54	—	0·23	—	7·29					
		30	—	5·10	34·01	26·90	1·46	—	0·23							
		40	—	5·10	34·01	26·90	1·50	—	0·24	—	7·30					
		50	—	4·81	34·01	26·93	1·65	—	0·23							
		60	—	4·43	34·02	26·99	1·69	—	0·22	—	7·15					
		80	—	3·96	34·03	27·05	1·86	—	0·24							
		100	—	3·83	34·06	27·08	1·96	—	0·26	—	6·88					
		150	—	3·58	34·12	27·15	2·09	—	0·00	—	6·48					
		200	—	3·46	34·15	27·19	2·01	—	0·00	—	6·35					
		300	—	3·05	34·16	27·23	2·22	—	0·00	—	6·05					
		400	—	2·64	34·17	27·28	2·30	—	0·00	—	5·70					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1193 *cont.*	46° 33·3′ S, 23° 09·4′ W	1933 22–23 xi											
1194	47° 35·8′ S, 23° 09·3′ W	23 xi	0807	3764*	W × N	20	W × N	5	bc	1002·2	6·7	5·6	heavy WNW swell
1195	47° 55·1′ S, 23° 10·2′ W	23 xi	1230	4336*	NW × N	25	NW × N	6–7	o	998·0	7·2	6·7	heavy swell
1196	48° 15·6′ S, 23° 58·9′ W	23 xi	2000	4526*	NW	25	NW	5	ome	997·7	6·4	5·9	heavy conf. WNW swell
1197	49° 33·7′ S, 27° 29′ W	24–25 xi	2000 0116	4219* —	NW NW	6 16	NW NW	3 4	oc o	997·0 997·2	3·9 3·9	3·3 3·4	mod. NW swell mod. WNW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1193 *cont.*	5	500	—	2·50	34·20	27·31	2·53	—	—	—	5·29					Considerable stray on hydrological wire at all depths below 500 m.
		600	—	2·50	34·27	27·37	2·62	—	—	—	4·89					
		700	—	2·40	34·34	27·44	2·66	—	—	—	4·59					
		800	—	2·50	34·41	27·48	2·72	—	—	—	4·30					
		900	—	2·53	34·48	27·54	2·66	—	—	—	4·10					
1194	6	0	—	5·47	34·04	26·88	1·37	—	0·24	—	7·21	**N 50 V**	100–0	0821		
		10	—	5·46	34·04	26·88	1·44	—	0·24	—	—	**N 70 V**	30–0			
		20	—	5·46	34·04	26·88	1·48	—	0·24	—	7·19	,,	50–0			
		30	—	5·46	34·04	26·88	1·52	—	0·24	—	—	,,	100–50			
		40	—	5·44	34·04	26·88	1·50	—	0·24	—	7·19	,,	250–100			
		50	—	5·44	34·04	26·88	1·44	—	0·24	—	—	,,	500–250			
		60	—	5·35	34·04	26·89	1·52	—	0·24	—	7·14	,,	500–0	—	1011	
		80	—	3·92	33·99	27·02	1·82	—	0·26							
		100	—	3·48	34·01	27·07	1·92	—	0·29	—	7·01					
		150	—	2·85	34·03	27·15	2·01	—	0·00	—	6·97					
		200	—	2·34	34·03	27·20	2·01	—	0·00	—	7·07					
		250	—	2·39												
		300	—	2·32	34·11	27·26	2·28	—	0·00	—	6·01					
		400	—	2·27	34·22	27·34	2·51	—	0·00	—	5·34					
		500^1	500	2·29	34·31	27·42	2·57	—	—	—	4·90					
		600^1	—	2·27	34·37	27·47	2·70	—	—	—	4·48					
		700^1	698	2·29	34·43	27·52	2·74	—	—	—	4·24					
		790^2	791	2·31	34·50	27·56	2·78	—	—	—	4·14					
		890^2	—	2·33	34·53	27·59	2·66	—	—	—	4·04					
		990^2	987	2·38	34·59	27·64	2·66	—	—	—	4·04					
1195	6	0	—	5·58	34·02	26·85	1·01	—	0·24	—	7·24	**N 50 V**	100–0	1241		
		10	—	5·58	34·02	26·85	1·03	—	0·22	—	—	**N 70 V**	50–0			
		20	—	5·57	34·02	26·86	1·03	—	0·24	—	7·25	,,	100–50			
		30	—	5·55	34·02	26·86	1·03	—	0·24	—	—	,,	250–100			
		40	—	5·54	34·02	26·86	1·05	—	0·24	—	7·26	,,	500–250	—	1337	
		50	—	5·52	34·02	26·86	1·06	—	0·24	—	—	**N 70 B**	170–0	1430	1450	KT
		60	—	4·68	34·02	26·96	1·20	—	0·24	—	7·12	**N 100 B**				
		80	—	3·95	34·02	27·04	1·35	—	0·24							
		95	—	3·37	34·03	27·10	1·44	—	0·28	—	7·11					
		140	—	2·46	34·01	27·17	1·46	—	0·00	—	7·16					
		185	—	2·16	34·01	27·19	1·52	—	0·00	—	7·20					
		280	—	2·16	34·13	27·28	1·69	—	0·00	—	6·09					
		375	—	2·24	34·25	27·37	1·86	—	0·00	—	5·26					
		470^1	469	2·30	34·29	27·40	2·07	—	—	—	4·77					
		570^1	—	2·35	34·38	27·47	2·07	—	—	—	4·40					
		670^1	—	2·31	34·43	27·51	2·11	—	—	—	4·24					
		760^2	765	2·30	34·48	27·56	2·15	—	—	—	4·09					
		860^2	—	2·39	34·53	27·59	2·07	—	—	—	4·22					
		950^2	953	2·31	34·59	27·64	2·07	—	—	—	4·09					
1196	6	0	—	3·73	33·90	26·96	1·27	—	0·21	12·1	7·37	**N 50 V**	100–0	**2014**		
		5	—	3·73	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	3·73	33·90	26·96	1·39	—	0·21	14·7	—	,,	100–50			
		20	—	3·73	33·90	26·96	1·27	—	0·22	13·7	7·38	,,	250–100			
		30	—	3·73	33·90	26·96	1·35	—	0·23	13·4	—	,,	500–250			
		40	—	3·73	33·90	26·96	1·37	—	0·23	13·4	7·37	,,	750–500			
		50	—	3·73	33·90	26·96	1·44	—	0·22	13·8	—	,,	1000–750	—	**2222**	
		60	—	3·71	33·91	26·97	1·69	—	0·24	12·8	7·39	**CWS**	0	**2224**		
		80	—	3·53	33·91	26·99	1·71	—	0·24	13·0	—	,,	5			
		100	—	2·79	33·94	27·08	1·98	—	0·24	15·2	7·28	,,	10			
		150	—	1·83	33·95	27·17	2·05	—	0·13	20·7	7·08	,,	20			
		200	—	1·70	34·06	27·26	2·32	—	0·00	29·9	6·28	,,	50			
		300	—	1·87	34·26	27·41	2·45	—	0·00	41·9	5·01	,,	100	—	**2242**	
		400	—	2·01	34·41	27·52	2·62	—	0·00	50·6	4·53					
		590^1	612?	2·23	34·56	27·62	2·62	—	—	64·1	4·05					
		780^1	—	2·34	34·65	27·68	2·62	—	—	64·1	4·12					
		980^2	981	2·24	34·68	27·72	2·38	—	—	66·3	4·12					
		1470^2	1465	1·98	34·75	27·80	2·24	—	—	69·6	4·46					
1197	7	0	—	3·00	33·93	27·05	1·84	—	0·22	0·0	7·59	**N 50 V**	100–0	**2014**		
		5	—	3·00	—	—	—	—	—	—	—	**N 70 V**	50–0			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1197 *cont.*	49° 33·7′ S, 27° 29′ W	1933 24–25 xi											
1198	50° 51·9′ S, 31° 25·6′ W	25 xi	2000	4204*	W × N	8	W × N	3	bc	997·2	2·5	2·1	mod. WNW swell
1199	52° 40′ S, 37° 06·4′ W	26–27 xi	2358	1836*	SW × W	10	SW × W	3	ce	993·5	1·1	0·6	mod. SW swell
1200	53° 00·8′ S, 37° 07′ W	27 xi	0455	2780*	SW	8	SW	3	c	996·7	1·1	0·6	mod. SW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S °/$_{oo}$	σt	Mg.—atom m.^{3}				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1197 *cont.*	7	10	—	3·00	33·93	27·05	1·81	—	0·22	0·0	—	N 70 V	100–50			
		20	—	2·98	33·93	27·05	1·81	—	0·22	0·0	7·63	,,	250–100			
		30	—	2·91	33·93	27·06	1·82	—	0·22	0·0	—	,,	500–250			
		40	—	2·79	33·93	27·07	1·81	—	0·22	0·0	7·59	,,	750–500			
		50	—	2·76	33·93	27·07	1·77	—	0·24	0·0	—	,,	1000–750	—	2308	
		60	—	2·75	33·93	27·07	1·79	—	0·23	0·0	7·56	NHP	50–0	2240	2257	
		80	—	2·74	33·94	27·08	1·77	—	0·22	11·3	—	CWS	0	2326		
		100	—	2·58	33·94	27·10	1·92	—	0·21	11·5	7·54	,,	5			
		150	—	1·91	34·03	27·23	2·19	—	0·23	22·4	6·94	,,	10			
		200	—	1·65	34·04	27·25	2·32	—	0·00	24·8	6·71	,,	20			
		300	—	2·12	34·17	27·32	2·51	—	0·00	41·5	5·65	,,	50			
		400	—	2·19	34·27	27·40	2·60	—	0·00	38·4	4·96	,,	100	—	2346	
		590^1	599	2·28	34·46	27·54	2·78	—	—	55·9	4·28	N 70 B N 100 B	119–0	0014	0034	KT
		790^1	—	2·37	34·58	27·63	2·60	—	—	67·8	3·97					
		980^1	976	2·12	34·64	27·70	2·68	—	—	69·1	4·01					
		1480^1	1486	2·09	34·75	27·79	2·43	—	—	70·2	4·36					
		1970^2	1984	1·73	34·75	27·82	2·22	—	—	79·4	4·15					
		2460^2	2456	1·11	34·72	27·83	2·47	—	—	93·1	4·38					
		2950^2	—	0·68	34·70	27·85	2·64	—	—	101·4	4·41					
		3440^2	—	0·34	34·69	27·85	2·64	—	—	103·5	4·66					
		3930^2	3919	0·14	34·68	27·86	2·62	—	—	114·3	4·80					
1198	8	0	—	2·03	33·96	27·16	1·81	—	0·26	0·0	7·90	N 50 V	100–0	2013		+4 hours
		5	—	2·04	—	—	—	—	—	—	—	N 70 V	50–0			
		10	—	2·03	33·96	27·16	1·75	—	0·26	0·0	—	,,	100–50			
		20	—	2·03	33·96	27·16	1·73	—	0·26	0·0	7·95	,,	250–100			
		30	—	2·03	33·96	27·16	1·69	—	0·26	0·0	—	,,	500–250			
		40	—	2·02	33·96	27·16	1·84	—	0·26	0·0	7·93	,,	750–500			
		50	—	2·01	33·96	27·16	1·81	—	0·27	0·0	—	,,	1000–750	—	2148	
		60	—	1·96	33·96	27·17	1·90	—	0·26	0·0	7·88	CWS	0	2050		
		80	—	1·83	33·97	27·18	1·81	—	0·26	0·0	—	,,	5			
		100	—	1·68	33·98	27·21	2·00	—	0·26	6·2	7·69	,,	10			
		150	—	0·75	34·04	27·31	2·19	—	0·16	24·4	7·36	,,	20			
		200	—	1·92	34·24	27·40	2·30	—	0·00	45·3	5·49	,,	50			
		300	—	2·15	34·42	27·51	2·49	—	0·00	50·2	4·54	,,	100	—	2110	
		400	—	2·27	34·53	27·60	2·49	—	0·00	60·1	4·07	NHP	50–0	2149		
		600^1	592	2·19	34·62	27·68	2·34	—	—	69·3	3·97	,,	100–50	—	2215	
		790^1	—	2·17	34·68	27·72	2·41	—	—	72·9	4·10	N 100 B	173–0	2308	2328	KT
		990^1	993	2·23	34·77	27·79	2·26	—	—	77·4	4·29					
		1490^1	1493	1·68	34·77	27·83	2·32	—	—	86·8	4·44					
		2000^2	2005	1·11	34·76	27·86	2·32	—	—	90·8	4·48					
		2500^2	—	0·67	34·73	27·87	2·51	—	—	94·2	4·62					
		2990^2	2995	0·34	34·72	27·88	2·51	—	—	98·0	4·84					
		3490^2	—	0·13	34·71	27·89	2·45	—	—	102·4	5·11					
		3990^2	3771?	−0·04	34·70	27·89	2·45	—	—	109·8	5·04					
1199	9	0	—	0·82	33·98	27·26	1·94	—	—	13·6	8·25	N 70 B N 100 B	168–0	0009	0029	KT
		5	—	0·82	—	—	—	—	—	—	—					
		10	—	0·82	33·98	27·26	2·07	—	—	14·4	—	N 50 V	100–0	0050		
		20	—	0·81	33·98	27·27	2·13	—	—	14·6	8·24	N 70 V	50–0			
		30	—	0·78	33·98	27·27	2·00	—	—	14·8	—	,,	100–50			
		40	—	0·71	33·98	27·27	2·01	—	—	16·3	8·10	,,	250–100			
		50	—	0·63	34·00	27·29	2·24	—	—	16·6	—	,,	500–250			
		60	—	0·62	34·00	27·29	2·11	—	—	15·5	8·06	,,	750–500			
		80	—	0·61	34·00	27·29	2·28	—	—	19·3	—	,,	1000–750	—	0227	
		100	—	0·17	34·01	27·32	2·28	—	—	24·3	7·93	CWS	0	0115		
		150	—	−0·03	34·07	27·38	2·60	—	—	43·2	7·20	,,	5			
		200	—	1·14	34·33	27·51	2·72	—	—	55·3	5·33	,,	10			
		300	—	1·95	34·53	27·62	3·21	—	—	67·7	4·29	,,	20			
		400	—	2·06	34·62	27·69	2·64	—	—	79·1	4·01	,,	50			
		600^1	599	1·92	34·69	27·74	2·51	—	—	90·3	3·96	,,	100	—	0135	
		800^1	806	1·79	34·71	27·78	2·03	—	—	95·9	4·13	NHP	50–0	0155		
		990^1	—	1·59	34·75	27·83	2·36	—	—	84·3	4·21	,,	100–0	—	0224	
		1490^1	1483	0·99	34·76	27·87	2·70	—	—	100·1	4·52					
1200	9	0	—	1·10	34·02	27·28	2·22	—	—	14·5	8·18	N 100 B	107–0	0503	0523	KT
		5	—	1·10	—	—	—	—	—	—	—	N 50 V	100–0	0603		

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1200 *cont.*	53° 00·8′ S, 37° 07′ W	1933 27 xi											
1201	53° 19·9′ S, 37° 07·4′ W	27 xi	1040	1525*	W	6–7	W	2	bc	997·4	2·7	1·1	low W swell
1202	53° 40·7′ S, 37° 07·3′ W	27 xi	1446	174*	NW	7	WNW	2	cs	996·6	1·7	0·7	low WNW swell
1203	54° 17·5′ S, 34° 14·4′ W	28 xi	0400	4139*	E × N	6	E × N	2	os	983·4	− 1·1	− 1·1	low conf. NE swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom $m.^3$							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1200	9	10	—	1·10	34·02	27·28	1·84	—	—	18·4	—	**N 70 V**	50–0			
cont.		20	—	1·10	34·02	27·28	2·17	—	—	28·1	8·17	,,	100–50			
		30	—	0·98	34·02	27·28	2·20	—	—	15·8	—	,,	250–100			
		40	—	0·96	34·02	27·29	2·49	—	—	15·9	7·99	,,	500–250			
		50	—	0·93	34·02	27·29	2·49	—	—	15·9	—	,,	750–500			
		60	—	0·91	34·04	27·30	2·01	—	—	13·7	7·92	,,	1000–750	—	0745	
		80	—	0·63	34·04	27·32	2·34	—	—	31·4	—	**CWS**	0			
		100	—	0·20	34·04	27·34	2·30	—	—	31·6	7·83	,,	5			
		150	—	−0·11	34·08	27·40	2·34	—	—	42·0	7·03	,,	10			
		200	—	0·99	34·32	27·52	2·53	—	—	50·4	5·48	,,	20			
		300	—	1·87	34·49	27·59	2·85	—	—	66·6	4·34	,,	50			
		400	—	1·97	34·54	27·63	2·83	—	—	76·4	4·12	,,	100			
		600[1]	596	1·90	34·67	27·74	3·04	—	—	76·0	3·99	**NHP**	50–0	0749		
		790[1]	—	1·81	34·72	27·78	2·85	—	—	90·7	4·12	,,	100–0	—	0813	
		990[1]	—	1·63	34·73	27·81	2·81	—	—	93·2	4·23					
		1490[2]	1491	1·17	34·73	27·84	2·81	—	—	102·0	4·43					
		1980[2]	1980	0·72	34·70	27·85	2·57	—	—	104·2	4·72					
		2480[2]	2478	0·37	34·69	27·85	2·70	—	—	109·9	4·83					
1201	10	0	—	1·41	34·04	27·27	1·77	—	—	17·9	7·98	**N 70 B**	93–0	1052	1112	KT
		5	—	1·41	—	—	—	—	—	—	—	**N 100 B**				
		10	—	1·38	34·04	27·27	1·56	—	—	15·4	—	**N 50 V**	100–0	1122		
		20	—	1·27	34·05	27·28	1·77	—	—	15·7	8·00	**N 70 V**	50–0			
		30	—	1·10	34·05	27·30	1·81	—	—	11·9	—	,,	100–50			
		40	—	1·03	34·05	27·30	1·77	—	—	15·9	7·87	,,	250–100			
		50	—	1·01	34·05	27·30	1·94	—	—	15·6	—	,,	500–250			
		60	—	1·01	34·05	27·30	1·65	—	—	15·7	7·79	,,	750–500			
		80	—	0·47	34·05	27·33	1·96	—	—	29·9	—	,,	1000–750	—	1249	
		100	—	0·31	34·09	27·37	1·84	—	—	30·6	7·72	**CWS**	0			
		150	—	0·05	34·14	27·44	1·90	—	—	43·7	7·20	,,	5			
		200	—	0·28	34·31	27·56	2·17	—	—	51·2	6·17	,,	10			
		300	—	1·64	34·55	27·67	2·17	—	—	68·2	4·37	,,	20			
		400	—	1·85	34·65	27·72	2·36	—	—	72·1	4·08	,,	50			
		600[1]	604	1·78	34·70	27·78	2·03	—	—	80·8	4·12	,,	100			
		800[1]	—	1·60	34·72	27·80	2·30	—	—	86·1	4·23	**NHP**	50–0	1223	1232	
		990[1]	994	1·50	34·73	27·82	2·43	—	—	93·0	4·35					
		1390[1]	1387	1·16	34·73	27·84	2·36	—	—	95·9	4·45					
1202	10	0	—	1·38	33·95	27·20	2·05	—	—	10·4	8·62	**N 70 B**	117–0	1455	1515	KT
		5	—	1·37	—	—	—	—	—	—	—	**N 100 B**				
		10	—	1·32	33·96	27·21	2·05	—	—	10·6	—	**N 50 V**	100–0	1524		
		20	—	1·03	33·97	27·24	1·81	—	—	11·2	8·45	**N 70 V**	50–0			
		30	—	0·93	33·98	27·26	2·00	—	—	11·5	—	,,	100–50			
		40	—	0·85	33·98	27·26	2·09	—	—	12·6	8·11	,,	150–100	—	1549	
		50	—	0·81	33·98	27·27	2·15	—	—	13·2	—	**CWS**	0			
		60	—	0·71	33·98	27·27	2·19	—	—	16·5	7·93	,,	5			
		80	—	0·50	33·98	27·28	2·13	—	—	21·7	—	,,	10			
		100	—	0·17	33·98	27·30	2·62	—	—	33·6	7·25	,,	20			
		150	—	0·20	34·13	27·41	2·53	—	—	37·9	6·73	,,	50			
												,,	100			
												NHP	50–0	1617	1628	
1203	11	0	—	0·10	33·90	27·23	2·00	—	—	10·4	8·41	**N 70 B**	110–0	0418	0438	KT
		5	—	0·10	—	—	—	—	—	—	—	**N 100 B**				
		10	—	0·10	33·90	27·23	1·92	—	—	10·5	—	**N 50 V**	100–0	0500		
		20	—	0·00	33·90	27·24	1·92	—	—	11·5	8·38	**N 70 V**	50–0			
		30	—	−0·23	33·90	27·25	1·81	—	—	12·5	—	,,	100–50			
		40	—	−0·24	33·90	27·25	1·75	—	—	13·0	8·19	,,	250–100			
		50	—	−0·26	33·90	27·25	1·79	—	—	12·7	—	,,	500–250			
		60	—	−0·30	33·90	27·25	1·79	—	—	18·9	8·14	,,	750–500			
		80	—	−0·35	33·90	27·26	2·17	—	—	15·6	—	,,	1000–750	—	0644	
		100	—	−0·62	33·91	27·28	2·19	—	—	22·1	5·96	**CWS**	0			
		150	—	0·58	34·17	27·43	2·38	—	—	38·4	5·95	,,	5			
		200	—	1·34	34·32	27·50	2·38	—	—	44·8	5·08	,,	10			
		295	—	1·85	34·49	27·59	2·49	—	—	54·8	4·36	,,	20			
		395	—	1·92	34·54	27·64	2·76	—	—	61·2	4·15	,,	50			
		590[1]	593	1·91	34·66	27·73	2·64	—	—	70·2	4·02	,,	100			
		790[1]	—	1·72	34·71	27·79	2·79	—	—	76·0	3·99	**NHP**	50–0	0618	0628	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1203 *cont.*	54° 17·5′ S, 34° 14·4′ W	1933 28 xi											
1204	54° 17·7′ S, 34° 48·6′ W	28 xi	1005	1849*	SE × E	14	SE × E	3	os	980·6	−0·6	−0·9	mod SE × E swell
1205	54° 20·2′ S, 35° 25·2′ W	28 xi	1447	260*	SSE	20	SSE	3	os	982·5	−1·1	−1·3	mod. conf. E and SE × S swells
1206	54° 22·2′ S, 35° 53·4′ W	28 xi	1823	174*	SSE	28	SSE	5	bcsq	987·2	−1·7	−2·3	mod. SSE swell
1207	3 miles S 60° E from Jason I, South Georgia	3 xii	1922	—	WNW	14	WNW	4	bc	989·2	0·0	−1·1	mod. WNW swell
1208	54° 04·2′ S, 38° 37·3′ W	4 xii	0658	182*	SW	6	SW	3	c	998·5	−0·5	−1·1	mod. SW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS					Mg.—atom m.^{3}					BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S °/₀₀	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	TIME From	TIME To	
1203 *cont.*	11	990^1	—	1·64	34·76	27·83	2·76	—	—	79·9	4·13					
		1480^1	1478	1·12	34·75	27·86	2·32	—	—	85·0	4·23					
		1940^2	1942	0·71	34·74	27·88	2·47	—	—	90·4	4·50					
		2430^2	—	0·41	34·72	27·88	2·49	—	—	90·1	4·72					
		2920^2	2911	0·21	34·72	27·89	2·36	—	—	96·3	4·83					
		3400^2	—	0·11	34·70	27·88	2·09	—	—	101·2	4·96					
		3890^2	3907	−0·11	34·69	27·88	2·05	—	—	110·8	5·14					
1204	11	0	—	0·21	33·95	27·27	2·28	—	—	10·5	8·39	**N 100 B**	95–0	1015	1035	KT
		5	—	0·21	—	—	—	—	—	—	—	**N 50 V**	100–0	1100		
		10	—	0·21	33·95	27·27	2·19	—	—	10·6	—	**N 70 V**	50–0			
		20	—	0·19	33·95	27·27	2·11	—	—	11·3	8·36	,,	100–50			
		30	—	−0·19	33·95	27·29	2·17	—	—	12·6	—	,,	250–100			
		40	—	−0·20	33·95	27·29	2·41	—	—	12·9	8·03	,,	500–250			
		50	—	−0·20	33·95	27·29	2·41	—	—	13·3	—	,,	750–450			
		60	—	−0·21	33·95	27·29	2·19	—	—	12·9	8·04	,,	1000–750	—	1257	
		80	—	−0·24	33·95	27·29	2·41	—	—	18·9	—	**CWS**	0			
		100	—	−0·53	33·96	27·31	2·30	—	—	23·0	7·71	,,	5			
		150	—	0·82	34·24	27·47	2·45	—	—	49·8	5·69	,,	10			
		200	—	1·56	34·35	27·51	2·78	—	—	55·8	4·80	,,	20			
		295	—	2·00	34·51	27·60	2·68	—	—	66·9	4·15	,,	50			
		390	—	2·05	34·60	27·67	2·89	—	—	73·5	4·00	,,	100			
		590^1	593	2·00	34·66	27·72	2·76	—	—	84·7	3·80	**NHP**	50–0	1215	1223	
		780^1	—	1·75	34·72	27·79	2·45	—	—	88·9	4·02					
		980^1	—	1·65	34·74	27·82	2·40	—	—	90·5	4·13					
		1460^1	1461	1·12	34·74	27·85	2·51	—	—	96·8	4·35					
1205	11	0	—	0·49	33·97	27·27	2·30	—	—	<6·7	8·24	**N 70 B**	73–0	1502	1522	KT
		5	—	0·49	—	—	—	—	—	—	—	**N 100 B**				
		10	—	0·49	33·97	27·27	2·19	—	—	<6·7	—	**N 70 V**	50–0	1547		
		20	—	0·48	33·97	27·27	2·15	—	—	<6·7	8·22	,,	100–50			
		30	—	0·47	33·97	27·28	2·22	—	—	<6·7	—	,,	220–100	—	1615	
		40	—	0·45	33·97	27·28	2·15	—	—	<6·7	8·20	**CWS**	0			
		50	—	0·39	33·97	27·28	2·15	—	—	<6·7	—	,,	5			
		60	—	0·30	33·97	27·28	2·15	—	—	11·5	8·10	,,	10			
		80	—	0·13	33·97	27·29	2·17	—	—	18·0	—	,,	20			
		100	—	0·06	33·97	27·30	2·30	—	—	28·4	7·88	,,	50			
		150	—	−0·40	34·03	27·37	2·17	—	—	38·1	7·48	,,	100			
		200	—	0·18	34·13	27·41	2·70	—	—	44·1	6·54	**NHP**	50–0	1613	1621	
1206	11	0	—	0·62	33·89	27·20	2·36	—	—	16·7	7·79	**N 70 B**	80–0	1828	1848	KT
		5	—	0·62	—	—	—	—	—	—	—	**N 100 B**				
		10	—	0·62	33·89	27·20	2·34	—	—	15·4	—	**N 50 V**	100–0	1913		
		20	—	0·62	33·90	27·21	2·41	—	—	15·7	7·80	**N 70 V**	50–0			
		30	—	0·62	33·91	27·22	2·59	—	—	14·6	—	,,	100–50	—	1933	
		40	—	0·61	33·91	27·22	2·32	—	—	15·3	7·82	**CWS**	0			
		50	—	0·61	33·91	27·22	2·41	—	—	16·4	—	,,	5			
		60	—	0·58	33·91	27·22	2·45	—	—	15·7	7·75	,,	10			
		80	—	0·22	33·91	27·24	2·70	—	—	17·6	—	,,	20			
		100	—	0·01	33·98	27·31	2·24	—	—	18·8	7·71	,,	50			
		150	—	−0·07	34·00	27·32	2·43	—	—	20·8	7·54	,,	100			
												NHP	50–0	2000	2006	
1207	16	0	—	1·50	33·84	27·10	—	—	—	—	—	**N 50 V**	100–0	1922	1929	+1 hour 30 minutes
1208	17	0	—	0·78	33·95	27·24	1·84	—	—	9·5	8·00	**N 70 B**	174–0	0720	0740	KT. +3 hours
		5	—	0·75	—	—	—	—	—	—	—	**N 100 B**				
		10	—	0·73	33·96	27·25	1·73	—	—	10·5	—	**N 50 V**	100–0	0746		
		20	—	0·73	33·96	27·25	1·94	—	—	10·3	7·96	**N 70 V**	50–0			
		30	—	0·73	33·96	27·25	1·96	—	—	10·5	—	,,	100–50	—	0813	
		40	—	0·73	33·96	27·25	1·82	—	—	<6·7	7·95	**CWS**	0			
		50	—	0·73	33·96	27·25	1·98	—	—	8·3	—	,,	5			
		60	—	0·73	33·96	27·25	2·03	—	—	9·4	7·95	,,	10			
		80	—	0·73	33·96	27·25	2·01	—	—	9·4	—	,,	20			
		100	—	0·72	33·96	27·25	1·86	—	—	9·5	7·89	,,	50			
		150	—	0·26	33·97	27·29	1·92	—	—	26·1	7·37	,,	100			
												NHP	50–0	0837	0847	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1209	54° 04′ S, 39° 12·8′ W	1933 4 xii	1043	210*	NNE	1–2	NNE	2	c	998·7	2·5	1·1	low WSW swell
1210	54° 05′ S, 39° 45·9′ W	4 xii	1433	591*	NE × E	14	NE × E	3	os	997·2	−0·8	−0·9	mod. SW swell
1211	54° 06·2′ S, 40° 18·9′ W.	4 xii	1839	1997*	NE	14	NE	3	ome	994·2	1·1	0·7	mod. conf. NE and SW swells
1212	55° 38·9′ S, 44° 52·5′ W	5–6 xii	2000	3762*	W × S	15	W × S	4	oe	993·1	0·1	−0·1	heavy W × S swell
			0034	—	W × S	16	W × S	4	oe	993·1	0·1	−0·2	heavy W × S swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.^{3}							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N$_2$	Nitrite N$_2$	Si	O$_2$ c.c. litre	Gear	Depth (metres)	From	To	
1209	17	0	—	1·41	33·97	27·22	1·88	—	—	8·4	7·82	**N 70 B**	126–0	1057	1117	KT
		5	—	0·94	—	—	—	—	—	—	—	**N 100 B**				
		10	—	0·90	33·97	27·25	1·96	—	—	8·4	—	**N 50 V**	100–0	1137		
		20	—	0·88	33·97	27·25	1·86	—	—	8·5	7·88	**N 70 V**	50–0			
		30	—	0·87	33·97	27·25	1·75	—	—	9·3	—	,,	100–50			
		40	—	0·88	33·97	27·25	2·05	—	—	9·4	7·83	,,	180–100	—	1200	
		50	—	0·90	33·97	27·25	2·17	—	—	<6·7	—	**CWS**	0			
		60	—	0·90	33·97	27·25	1·96	—	—	<6·7	7·78	,,	5			
		80	—	0·89	33·97	27·25	2·01	—	—	11·1	—	,,	10			
		100	—	0·79	33·97	27·26	2·26	—	—	17·8	7·42	,,	20			
		150	—	0·71	34·08	27·35	2·53	—	—	34·5	6·57	,,	50			
		200	—	0·73	34·08	27·35	2·47	—	—	38·1	6·42	,,	100			
												NHP	50–0	1204	1210	
1210	17	0	—	0·80	33·96	27·25	2·30	—	—	8·4	8·07	**N 70 B**	96–0	1443	1503	KT
		5	—	0·79	—	—	—	—	—	—	—	**N 100 B**				
		10	—	0·79	33·96	27·25	1·98	—	—	8·4	—	**N 50 V**	100–0	1521		
		20	—	0·75	33·96	27·25	1·84	—	—	9·3	8·02	**N 70 V**	50–0			
		30	—	0·70	33·96	27·25	1·75	—	—	9·5	—	,,	100–50			
		40	—	0·65	33·96	27·25	1·82	—	—	<6·7	7·87	,,	250–100			
		50	—	0·64	33·96	27·26	1·92	—	—	8·3	—	,,	500–250	—	1614	
		60	—	0·64	33·96	27·26	1·88	—	—	9·3	7·85	**CWS**	0			
		80	—	0·47	33·96	27·27	1·84	—	—	14·9	—	,,	5			
		100	—	−0·02	33·99	27·32	2·15	—	—	27·2	7·23	,,	10			
		150	—	0·70	34·15	27·41	2·41	—	—	36·4	5·97	,,	20			
		200	—	1·21	34·27	27·47	2·36	—	—	48·5	5·23	;,	50			
		300	—	1·79	34·44	27·57	2·45	—	—	60·1	4·36	,,	100			
		400	—	1·95	34·57	27·65	2·40	—	—	68·6	4·04	**NHP**	50–0	1617	1624	
		550	—	1·95	34·67	27·73	2·40	—	—	75·1	3·99					
1211	17	0	—	0·41	33·87	27·20	1·90	—	—	8·4	7·79	**N 70 B**	104–0	1847	1907	KT
		5	—	0·41	—	—	—	—	—	—	—	**N 100 B**				
		10	—	0·41	33·87	27·20	1·82	—	—	8·4	—	**N 50 V**	100–0	1930		
		20	—	0·38	33·87	27·20	1·90	—	—	9·3	7·79	**N 70 V**	50–0			
		30	—	0·38	33·87	27·20	1·88	—	—	9·5	—	,,	100–50			
		40	—	0·31	33·87	27·20	1·81	—	—	0·0	7·75	,,	250–100			
		50	—	0·30	33·87	27·20	1·92	—	—	0·0	—	,,	500–250			
		60	—	0·29	33·87	27·20	1·77	—	—	10·5	7·73	,,	750–500			
		80	—	−0·11	33·89	27·24	2·24	—	—	13·7	—	,,	1000–750	—	**2106**	
		100	—	−0·62	33·90	27·27	1·84	—	—	21·5	7·67	**CWS**	0			
		150	—	0·47	34·10	27·37	2·26	—	—	32·4	6·21	,,	5			
		200	—	1·28	34·25	27·44	2·26	—	—	42·9	5·16	,,	10			
		300	—	1·82	34·42	27·53	2·51	—	—	50·0	4·41	,,	20			
		400	—	1·98	34·52	27·61	2·43	—	—	56·7	4·05	,,	50			
		600[1]	603	2·07	34·58	27·65	2·15	—	—	58·9	3·73	,,	100			
		790[1]	787	2·02	34·66	27·72	2·11	—	—	64·8	3·91	**NHP**	50–0	**2108**	**2113**	
		990[1]	—	1·80	34·70	27·77	2·07	—	—	73·2	3·98					
		1490[1]	—	1·22	34·70	27·82	2·20	—	—	81·5	4·43					
1212	18	0	—	0·55	33·86	27·17	2·00	—	0·25	6·3	7·87	**N 50 V**	100–0	**2018**		+4 hours
		5	—	0·55	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·55	33·86	27·17	1·84	—	0·26	6·8	—	,,	100–50			
		20	—	0·55	33·86	27·17	2·07	—	0·26	6·7	7·88	,,	250–100			
		30	—	0·53	33·84	27·16	2·19	—	0·26	6·7	—	,,	500–250			
		40	—	0·53	33·86	27·17	1·86	—	0·26	6·7	7·85	,,	750–500			
		50	—	0·52	33·86	27·17	2·17	—	0·26	<3·3	—	,,	1000–750	—	**2252**	
		60	—	0·31	33·86	27·18	2·05	—	0·26	10·2	7·79	**CWS**	0			
		80	—	0·19	33·86	27·19	2·22	—	0·26	11·7	—	,,	5			
		100	—	−0·80	33·90	27·28	2·36	—	0·22	23·2	7·68	,,	10			
		150	—	−0·30	34·07	27·40	2·45	—	0·14	35·6	6·57	,,	20			
		200	—	1·12	34·33	27·51	2·64	—	0·00	46·0	4·99	,,	50			
		300	—	1·74	34·51	27·62	2·87	—	0·00	54·7	4·23	,,	100			
		400	—	1·82	34·60	27·68	2·64	—	—	58·8	4·10	**NHP**	50–0	**2150**	**2200**	
		600[1]	600	2·01	34·66	27·72	2·74	—	—	63·9	3·90	**N 70 B**	155–0	**2353**	**0013**	KT
		800[1]	—	1·90	34·70	27·77	2·74	—	—	69·3	3·96	**N 100 B**				
		990[2]	981	1·80	34·71	27·78	2·59	—	—	69·0	3·89	**N 70 B**	380–115	**2353**	**0024**	DGP
		1480[2]	—	1·28	34·72	27·82	2·36	—	—	73·8	4·33	**N 100 B**				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1212 *cont.*	55° 38·9′ S, 44° 52·5′ W	1933 5–6 xii											
1213	57° 41·7′ S, 48° 47′ W	6 xii	2000	3681*	Lt airs	2	—	1	o	992·9	0·3	−0·5	mod. ENE swell
1214	58° 38·9′ S, 53° 45·6′ W	7–8 xii	2000	3089*	ESE	15	SE	3	c	996·9	−2·5	−2·5	mod. SE × E swell
1215	61° 10·5′ S, 57° 49·2′ W	8–9 xii	2000 0028	3208* —	SE × S SE × S	25 20	SE × S SE × S	4 4	o o	1006·0 1007·0	−2·8 −2·8	−3·9 −3·9	heavy SE × S swell heavy SE × S swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
1212 *cont.*	18	1970^{2}	1979	0·88	34·70	27·84	2·51	—	—	85·8	4·42					
		2480^{3}	2476	0·51	34·69	27·84	2·34	—	—	95·4	4·57					
		2980^{3}	—	0·35	34·69	27·85	2·55	—	—	100·2	4·64					
		3470^{3}	3475	0·31	34·68	27·85	2·28	—	—	105·4	4·51					
1213	19	0	—	0·75	33·88	27·19	1·84	—	0·22	16·7	7·68	**N 50 V**	100–0	**2013**		
		5	—	0·44	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·40	33·88	27·21	1·81	—	0·21	16·7	—	,,	100–50			
		20	—	0·40	33·88	27·21	1·86	—	0·21	18·7	7·70	,,	250–100			
		30	—	0·39	33·88	27·21	1·98	—	0·19	16·7	—	,,	500–250			
		40	—	0·31	33·88	27·21	2·07	—	0·19	17·3	7·65	,,	750–500			
		50	—	0·22	33·88	27·22	2·01	—	0·20	15·2	—	,,	1000–750	—	**2145**	
		60	—	−0·06	33·89	27·23	2·13	—	0·21	21·3	7·68	**CWS**	0			
		80	—	−0·23	33·94	27·28	2·01	—	0·24	23·1	—	,,	5			
		100	—	−0·39	33·98	27·33	2·11	—	0·22	26·3	7·56	,,	10			
		150	—	0·92	34·18	27·42	2·28	—	0·00	36·1	5·68	,,	20			
		200	—	1·62	34·30	27·46	2·79	—	0·00	43·4	4·84	,,	50			
		300	—	2·00	34·42	27·52	2·79	—	0·00	55·4	4·19	,,	100			
		400	—	2·22	34·53	27·60	2·60	—	—	59·8	3·93	**NHP**	50–0	**2148**	**2154**	
		600^{1}	591	2·16	34·62	27·69	2·36	—	—	70·2	3·69	**N 70 B**	141–0	**2249**	**2309**	KT
		800^{1}	—	2·03	34·68	27·74	1·81	—	—	76·0	3·79	**N 100 B**				
		1000^{1}	—	1·90	34·70	27·77	2·51	—	—	84·5	3·87	**N 70 B**	390–110	**2249**	**2321**	DGP
		1500^{1}	1504	1·45	34·71	27·81	2·00	—	—	87·7	4·14	**N 100 B**				
		1940^{2}	1956	1·08	34·70	27·83	2·15	—	—	101·2	4·13					
		2430^{2}	2420	0·75	34·69	27·83	2·17	—	—	133·7	4·42					
		2910^{2}	—	0·37	34·69	27·85	2·15	—	—	136·8	4·65					
		3400^{2}	3396	0·18	34·67	27·85	1·58	—	—	143·4	4·70					
1214	21	0	—	−0·61	33·93	27·29	1·81	—	0·18	40·0	8·00	**N 50 V**	100–0	**2007**		+5 hours
		5	—	−0·60	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·58	33·95	27·31	1·98	—	0·18	42·6	—	,,	100–0			
		20	—	−0·54	33·95	27·31	2·09	—	0·19	45·7	7·97	,,	100–50			
		30	—	−0·54	33·95	27·31	1·81	—	0·19	44·3	—	,,	250–100			
		40	—	−0·54	33·95	27·31	2·32?	—	0·18	43·7	7·91	,,	500–250			
		50	—	−0·54	33·96	27·32	1·94	—	0·18	43·6	—	,,	750–500			
		60	—	−0·89	34·01	27·37	2·30	—	0·16	47·1	7·53	,,	1024–787	—	**2335**	
		80	—	−0·73	34·16	27·48	2·30	—	0·13	50·6	—	**CWS**	0			
		100	—	−0·44	34·29	27·57	2·45	—	0·12	61·6	6·14	,,	5			
		150	—	0·11	34·37	27·61	2·51	—	0·09	66·8	5·45	,,	10			
		200	—	1·32	34·55	27·69	2·47	—	0·00	68·6	4·34	,,	20			
		300	—	1·58	34·61	27·72	2·47	—	0·00	77·7	4·20	,,	50			
		400	—	1·56	34·65	27·74	2·49	—	—	81·3	4·20	,,	100			
		600^{1}	600	1·43	34·67	27·77	2·24	—	—	83·0	4·18	**NHP**	50–0	**2221**	**2230**	
		800^{1}	821	1·26	34·71	27·82	2·24	—	—	89·2	4·21	**N 70 B**	99–0	**2346**	**0006**	KT
		1000^{1}	—	1·12	34·70	27·82	2·34	—	—	96·1	4·21	**N 100 B**				
		1430^{2}	1418	0·70	34·69	27·83	2·15	—	—	104·1	4·39	**N 70 B**	285–135	**2346**	**0016**	DGP
		1900^{2}	1897	0·22	34·67	27·85	2·13	—	—	110·7	4·65	**N 100 B**				
		2380^{2}	—	0·01	34·66	27·85	2·15	—	—	112·7	4·73					
		2850^{2}	2879	−0·18	34·65	27·85	2·26	—	—	132·5	4·85					
1215	20	0	—	−0·59	33·98	27·34	2·43	—	0·11	38·2	7·74	**N 50 V**	100–0	**2013**		
		5	—	−0·59	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·59	33·98	27·34	2·15	—	0·10	36·1	—	,,	100–50			
		20	—	−0·59	33·98	27·34	2·40	—	0·11	36·6	7·71	,,	250–100			
		30	—	−0·59	33·98	27·34	2·28	—	0·10	36·9	—	,,	500–250			
		40	—	−0·59	33·98	27·34	2·19	—	0·10	34·4	7·72	,,	750–500			
		50	—	−0·59	33·98	27·34	2·51	—	0·09	38·4	—	,,	1000–750	—	**2152**	
		60	—	−0·59	33·98	27·34	2·30	—	0·09	39·7	7·75	**CWS**	0			
		80	—	−0·58	33·98	27·34	2·38	—	0·09	41·1	—	,,	5			
		100	—	−0·51	34·14	27·46	2·59	—	0·09	47·2	6·34	,,	10			
		150	—	0·50	34·40	27·61	2·34	—	0·06	64·6	4·85	,,	20			
		200	—	1·33	34·58	27·71	2·36	—	0·00	73·8	4·20	,,	50			
		300	—	1·70	34·64	27·73	2·72	—	0·00	77·0	4·01	,,	100			
		400	—	1·77	34·71	27·79	2·45	—	—	84·3	3·99	**NHP**	50–0	**2135**	**2149**	
		580^{1}	584	1·72	34·75	27·82	2·26	—	—	88·8	3·85	**N 70 B**	93–0	**2338**	**2358**	KT
		780^{1}	—	1·50	34·75	27·84	2·15	—	—	96·7	4·06	**N 100 B**				
		970^{2}	959	1·38	34·74	27·84	2·36	—	—	102·0	4·07	**N 70 B**	260–100	**2338**	**0016**	DGP
		1500^{2}	1503	1·01	34·73	27·85	2·57	—	—	115·9	4·22	**N 100 B**				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1215 *cont.*	61° 10·5′ S, 57° 49·2 W	1933 8–9 xii											
1216	63° 22·5′ S, 61° 48′ W	9 xii	2207	172*	SW	20	SW	4	c	1008·2	−1·7	−1·7	mod. SW swell
1217	64° 05·7′ S, 64° 18·5′ W	10 xii	1002	483*	SW	18	SW	3	ome	1003·9	0·0	0·0	mod. SW swell
1218	64° 48·1′ S, 67° 26·2′ W	10 xii	2200	368*	NW × N	15	NW × N	4	oms	988·9	0·0	−0·1	mod. conf. W swell
1219	66° 16·3′ S, 76° 30·1′ W	13 xii	1000	3583*	SW	20	SW	4	bc	1003·6	0·0	−0·7	mod. SW × S swell
1220	67° 45·3′ S, 77° 50·6′ W	13–14 xii	2100	3822*	NW × N	10	NW × N	2	ome	999·4	0·8	0·8	low NW swell
			0030	—	NW × N	6	NW × N	2	omed	999·0	−0·6	−0·6	low NW × N swell
1221	66° 26·1′ S, 78° 01·7′ W	14 xii	0900	3961*	W × S	14	W × S	4	c	1000·1	0·3	0·3	mod. W × S swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	Mg.—atom m.^{3}				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1215	20	2000^{2}	—	0·63	—	—	2·38	—	—	124·4	4·42					
cont.		2500^{2}	—	0·48	34·70	27·86	2·38	—	—	133·4	4·44					
		2910^{1}	2936	0·33	34·69	27·85	2·38	—	—	134·9	4·60					
1216	21	0	—	−0·15	33·71	27·10	—	—	—	—	—	**N 50 V**	100–0	**2215**		
												NHP	50–0	—	**2225**	
												N 70 B **N 100 B**	154–0	**2230**	**2250**	KT
1217	22	0	—	−0·35	33·71	27·11	—	—	—	—	—	**N 50 V**	100–0	1006		
												NHP	50–0	—	1027	
												N 70 B **N 100 B**	185–0	1034	1054	KT
1218	23	0	—	0·45	33·91	27·23	—	—	—	—	—	**N 50 V**	100–0	**2204**		
												NHP	50–0	—	**2237**	
												N 70 B **N 100 B**	131–0	**2245**	**2305**	KT
1219	26	0	—	−0·62	33·98	27·34	—	—	—	—	—	**N 50 V**	100–0	1002	1010	
												N 70 B **N 100 B**	170–0	1028	1048	KT
												N 70 B **N 100 B**	460–140	1028	1059	DGP
1220	26	0	—	−1·11	33·90	27·29	2·22	—	0·16	34·7	7·61	**N 50 V**	100–0	2102		
		5	—	−1·11	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·11	33·91	27·30	2·13	—	0·15	34·5	—	,,	100–50			
		20	—	−1·20	33·91	27·30	2·22	—	0·16	34·0	7·58	,,	250–100			
		30	—	−1·30	33·91	27·30	2·22	—	0·16	34·8	—	,,	500–250			
		40	—	−1·30	33·91	27·30	2·34	—	0·14	36·5	7·60	,,	750–500			
		50	—	−1·29	33·91	27·30	2·24	—	0·14	35·8	—	,,	1000–750	—	2229	
		60	—	−1·29	33·94	27·32	2·15	—	0·14	36·4	7·67	**NHP**	50–0	2235	2241	
		80	—	−1·30	33·95	27·33	2·07	—	0·14	35·9	—	**CWS**	0			
		100	—	−1·50	34·06	27·43	2·22	—	0·19	35·2	7·04	,,	5			
		150	—	1·00	34·41	27·59	2·22	—	0·27	52·4	4·63	,,	10			
		200	—	1·49	34·52	27·65	2·83	—	0·00	60·8	4·06	,,	20			
		300	—	1·78	34·60	27·69	2·57	—	0·00	69·7	3·88	,,	50			
		390	—	1·88	34·69	27·75	2·57	—	—	75·3	3·89	,,	100			
		590^{1}	—	1·79	34·71	27·78	2·64	—	—	76·7	3·74	**N 70 B** **N 100 B**	135–0	2347	**0007**	KT
		780^{1}	768	1·65	34·72	27·80	2·64	—	—	81·9	3·86					
		980^{1}	—	1·53	34·72	27·80	2·41	—	—	85·7	4·02	**N 70 B** **N 100 B**	420–240	2347	**0019**	DGP
		1470^{1}	1486	1·13	34·71	27·83	2·72	—	—	92·4	4·11					
		1980^{2}	1979	0·88	34·70	27·84	2·57	—	—	98·4	4·06					
		2480^{2}	2477	0·62	34·69	27·84	2·40	—	—	106·7	4·21					
		2970^{2}	—	0·41	34·69	27·85	2·51	—	—	120·5	4·18					
		3470^{2}	—	0·22	34·68	27·86	2·32	—	—	136·8	4·40					
1221	27	0	—	−0·83	33·98	27·35	2·15	—	0·13	22·2	7·80	**N 50 V**	100–0	0912		
		5	—	−0·83	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·72	33·98	27·34	2·20	—	0·09	24·9	—	,,	100–50			
		20	—	−0·73	33·98	27·34	2·20	—	0·09	25·6	7·80	,,	250–100			
		30	—	−0·74	33·98	27·34	2·09	—	0·10	26·9	—	,,	500–250			
		40	—	−0·75	33·98	27·34	2·05	—	0·10	28·3	7·78	,,	750–500			
		50	—	−0·80	33·98	27·35	2·22	—	0·10	29·0	—	,,	1000–750	—	1043	
		60	—	−0·80	33·98	27·35	2·11	—	0·08	30·3	7·80	**NHP**	50–0	1035	1041	
		80	—	−0·81	33·98	27·35	2·13	—	0·08	30·5	—	**CWS**	0			
		100	—	−1·13	34·01	27·38	2·26	—	0·09	31·9	7·27	,,	5			
		150	—	1·02	34·42	27·59	2·53	—	0·06	54·8	4·48	,,	10			
		200	—	1·41	34·50	27·63	2·64	—	0·03	58·1	4·13	,,	20			
		300	—	1·74	34·58	27·68	2·51	—	0·00	63·1	3·91	,,	50			
		400	—	1·89	34·61	27·70	2·66	—	—	64·6	3·91	,,	100			
		590^{1}	605	1·84	34·68	27·75	2·79	—	—	71·6	3·77	**N 70 B** **N 100 B**	88–0	1107	1127	KT
		790^{1}	—	1·71	34·70	27·78	2·79	—	—	72·9	3·96					
		990^{1}	984	1·59	34·70	27·79	2·79	—	—	79·1	3·96	**N 70 B** **N 100 B**	290–165	1107	1136	DGP
		1480^{1}	—	1·20	34·70	27·82	2·79	—	—	88·7	4·20					
		1980^{1}	1980	0·93	34·69	27·82	2·70	—	—	96·9	4·23					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1222	65° 02·7′ S, 78° 01·7′ W	1933 14 xii	2000	4159*	W × S	15	W × S	4	ofe	1003·5	0·0	0·0	mod. W swell
1223	63° 31·9′ S, 78° 01·6′ W	15 xii	0900	4309*	W × S	18	W × S	4	o	1010·7	0·6	0·1	mod. W × S swell
1224	62° 11·5′ S, 78° 01·1′ W	15–16 xii	2000	4923*	W × N	20	W × N	4	ome	1009·9	2·8	2·8	mod. W swell
			0040	—	W × S	20	W × S	4	ome	1005·7	2·8	2·8	mod. W × S swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
1222	27	0	—	−0·56	33·89	27·26	2·36	—	0·11	22·1	7·77	**N 50 V**	100–0	2009		
		5	—	−0·55	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·55	33·90	27·27	2·43	—	0·12	23·7	—	,,	100–50			
		20	—	−0·52	33·89	27·25	2·28	—	0·14	24·6	7·77	,,	250–100			
		30	—	−0·51	33·90	27·26	2·43	—	0·14	28·6	—	,,	500–250			
		40	—	−0·54	33·91	27·28	2·32	—	0·13	29·2	7·76	,,	750–500			
		50	—	−0·55	33·92	27·29	2·43	—	0·11	30·0	—	,,	1000–750	—	2137	
		60	—	−0·59	33·92	27·29	2·49	—	0·11	34·2	7·76	**NHP**	50–0	2125	2130	
		80	—	−0·81	33·92	27·30	2·36	—	0·11	34·1	—	**CWS**	0			
		100	—	−1·50	33·99	27·38	2·07	—	0·16	34·0	7·20	,,	5			
		150	—	0·60	34·33	27·55	2·85	—	0·09	48·5	4·93	,,	10			
		200	—	1·48	34·50	27·63	3·00	—	0·00	57·1	4·24	,,	20			
		300	—	1·76	34·57	27·67	2·85	—	0·00	60·5	3·94	,,	50			
		400	—	1·95	34·63	27·70	3·06	—	—	62·9	3·86	,,	100			
		600[1]	604	1·90	34·68	27·75	2·55	—	—	69·0	3·82	**N 70 B**	110–0	**2310**	**2330**	KT
		800[1]	—	1·79	34·71	27·78	2·55	—	—	73·6	3·87	**N 100 B**				
		1000[1]	—	1·66	34·71	27·79	2·43	—	—	76·7	3·97	**N 70 B**	370–160	**2310**	**2341**	DGP
		1490[1]	1493	1·33	34·71	27·82	2·07	—	—	81·3	4·18	**N 100 B**				
		1970[2]	1985	1·01	34·70	27·83	1·50	—	—	88·9	4·17					
		2470[2]	—	0·73	34·69	27·83	2·09	—	—	104·1	4·23					
		2960[2]	2960	0·56	34·69	27·84	2·36	—	—	113·9	4·33					
		3460[2]	—	0·40	34·69	27·85	2·01	—	—	136·1	4·47					
		3950[2]	3945	0·35	34·67	27·84	2·11	—	—	143·3	4·28					
1223	28	0	—	−0·05	33·86	27·20	2·20	—	0·22	15·9	7·64	**N 50 V**	100–0	0910		
		5	—	−0·06	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·07	33·86	27·20	2·13	—	0·24	15·6	—	,,	100–50			
		20	—	−0·07	33·86	27·20	1·84	—	0·24	16·0	7·63	,,	250–100			
		30	—	−0·07	33·86	27·20	2·17	—	0·24	15·0	—	,,	500–250			
		40	—	−0·07	33·86	27·20	1·98	—	0·24	16·2	7·65	,,	750–500			
		50	—	−0·09	33·86	27·20	2·20	—	0·24	14·4	—	,,	1000–750	—	1045	
		60	—	−0·10	33·86	27·21	1·90	—	0·24	14·4	7·64	**NHP**	50–0	1025	1030	
		80	—	−0·19	33·86	27·21	2·26	—	0·24	16·2	—	**CWS**	0			
		100	—	−0·81	33·86	27·24	2·13	—	0·19	18·8	7·47	,,	5			
		150	—	−0·18	33·97	27·31	2·28	—	0·03	23·7	6·93	,,	10			
		200	—	0·90	34·11	27·36	2·36	—	0·00	28·5	6·03	,,	20			
		300	—	1·92	34·32	27·46	2·51	—	0·00	33·7	4·79	,,	50			
		400	—	2·30	34·35	27·46	2·76	—	—	44·6	4·54	,,	100			
		600[1]	601	2·15	34·51	27·59	2·40	—	—	55·5	3·69	**N 70 B**	90–0	1108	1128	KT
		790[1]	—	2·14	34·61	27·68	2·26	—	—	61·3	3·64	**N 100 B**				
		990[1]	993	2·11	34·68	27·73	2·34	—	—	64·7	3·61	**N 70 B**	300–190	1108	1139	DGP
		1490[1]	—	1·80	34·70	27·77	2·36	—	—	71·8	3·81	**N 100 B**				
		1980[1]	1977	1·46	34·72	27·81	2·41	—	—	79·1	4·09					
1224	28	0	—	1·80	33·99	27·21	2·49	—	0·16	15·1	7·30	**N 50 V**	100–0	2008		
		5	—	1·80	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	1·80	34·00	27·21	2·38	—	0·16	15·9	—	,,	100–50			
		20	—	1·79	34·00	27·21	2·38	—	0·16	14·7	7·30	,,	250–100			
		30	—	1·79	34·00	27·21	2·24	—	0·16	15·3	—	,,	500–250			
		40	—	1·74	34·00	27·21	2·53	—	0·16	16·0	7·30	,,	750–500			
		50	—	1·73	34·00	27·21	2·41	—	0·16	15·0	—	,,	1000–750	—	2134	
		60	—	1·72	34·00	27·21	1·81	—	0·16	16·1	7·29	**NHP**	50–0	2115	2120	
		80	—	1·70	34·00	27·21	2·38	—	0·15	18·0	—	**CWS**	0			
		100	—	1·68	34·01	27·23	2·20	—	0·15	19·0	7·20	,,	5			
		150	—	1·42	34·04	27·26	2·15	—	0·15	22·6	6·76	,,	10			
		200	—	1·25	34·06	27·30	2·30	—	0·09	24·4	6·38	,,	20			
		300	—	1·54	34·15	27·36	2·47	—	0·00	28·2	5·95	,,	50			
		400	—	2·23	34·23	27·36	3·14	—	—	38·4	4·95	,,	100			
		600[1]	601	2·39	34·41	27·49	2·43	—	—	48·4	3·87	**N 70 B**	117–0	**2354**	**0014**	KT
		790[1]	—	2·28	34·50	27·57	2·45	—	—	52·5	3·66	**N 100 B**				
		990[1]	986	2·25	34·57	27·63	2·78	—	—	56·8	3·64	**N 70 B**	410–0	**2354**	**0033**	DGP
		1490[1]	—	2·01	34·68	27·74	2·51	—	—	62·1	3·81	**N 100 B**				
		1990[1]	1997	1·67	34·70	27·78	2·62	—	—	71·2	3·97					
		2490[2]	2497	1·36	34·70	27·81	2·19	—	—	77·9	3·95					
		2990[2]	—	1·05	34·70	27·83	2·62	—	—	84·8	4·14					
		3480[2]	3478	0·77	34·69	27·83	2·20	—	—	90·2	4·28					
		3980[2]	—	0·49	34·69	27·84	1·92	—	—	96·6	4·22					
		4480[2]	4478	0·46	34·68	27·84	2·34	—	—	104·8	4·29					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1225	60° 53·6′ S, 77° 58·4′ W	1933 16 xii	0900	5000*	W × N	15	W × N	4	ome	1007·2	4·0	4·0	mod. W × N swell
1226	59° 31·7′ S, 78° 04′ W	16 xii	2000	4938*	W × N	20	W × N	4	omd	1007·2	4·7	4·7	mod. W × N swell
1227	58° 05·4′ S, 78° 17·4′ W	17 xii	0900	4536*	W × N	17	W × N	4	omd	1007·1	5·4	5·4	mod. W × N swell
1228	56° 39′ S, 78° 31·7′ W	17 xii	2000	4718*	WSW	10	WSW	3	ome	1009·2	5·9	5·9	mod. WSW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1225	29	0	—	3·32	34·06	27·13	2·22	—	0·17	12·5	6·99	**N 50 V**	100–0	0905		
		5	—	3·32	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	3·31	34·07	27·14	2·49	—	0·17	12·2	—	,,	100–50			
		20	—	3·31	34·07	27·14	2·28	—	0·16	12·2	6·98	,,	250–100			
		30	—	3·31	34·07	27·14	2·15	—	0·16	12·9	—	,,	500–250			
		40	—	3·27	34·07	27·14	2·38	—	0·16	11·5	6·99	,,	750–500			
		50	—	3·26	34·07	27·14	2·38	—	0·16	12·6	—	,,	1000–750	—	1030	
		60	—	3·24	34·07	27·15	2·40	—	0·15	13·3	6·96	**NHP**	50–0	1022	1027	
		80	—	3·15	34·07	27·16	2·19	—	0·14	13·2	—	**CWS**	0			
		100	—	3·13	34·07	27·16	2·17	—	0·15	14·5	6·86	,,	5			
		150	—	3·11	34·07	27·16	2·17	—	0·16	12·9	6·84	,,	10			
		200	—	2·71	34·09	27·20	2·45	—	0·12	16·8	6·62	,,	20			
		300	—	2·47	34·10	27·23	2·68	—	0·06	17·0	6·41	,,	50			
		395	—	2·51	34·13	27·25	2·68	—	0·00	21·6	6·02	,,	100			
		590[1]	601	2·73	34·25	27·33	2·64	—	—	35·1	4·66	**N 70 B**	95–0	1049	1109	KT
		790[1]	—	2·63	34·38	27·45	2·91	—	—	44·3	4·03	**N 100 B**				
		990[1]	983	2·47	34·49	27·54	2·91	—	—	49·2	3·72	**N 70 B**	340–150	1049	1118	DGP. Closing depth estimated
		1480[1]	—	2·22	34·66	27·70	3·02	—	—	64·4	3·70	**N 100 B**				
		1970[1]	1974	1·94	34·74	27·79	2·93	—	—	69·4	3·88					
1226	29	0	—	3·83	34·12	27·13	2·34	—	0·19	11·4	6·94	**N 50 V**	100–0	2006		
		5	—	3·83	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	3·83	34·12	27·13	2·70	—	0·18	10·3	—	,,	100–50			
		20	—	3·83	34·12	27·13	2·34	—	0·18	9·2	6·96	,,	250–100			
		30	—	3·83	34·12	27·13	2·34	—	0·19	9·8	—	,,	500–250			
		40	—	3·83	34·12	27·13	2·49	—	0·19	10·6	6·94	,,	750–500			
		50	—	3·82	34·12	27·13	2·66	—	0·18	11·1	—	,,	1000–750	—	2119	
		60	—	3·81	34·12	27·13	2·49	—	0·18	11·5	6·96	**NHP**	50–0	2131	2136	
		80	—	3·74	34·13	27·14	2·26	—	0·18	11·8	—	**CWS**	0			
		100	—	3·68	34·13	27·14	2·13	—	0·18	11·9	6·84	,,	5			
		150	—	3·25	34·13	27·18	2·36	—	0·24	12·8	6·73	,,	10			
		195	—	2·99	34·11	27·20	2·51	—	0·06	20·0	6·62	,,	20			
		295	—	2·86	34·13	27·22	2·76	—	0·00	27·0	6·32	,,	50			
		390	—	2·76	34·16	27·26	2·87	—	0·00	22·1	5·92	,,	100			
		590[1]	—	2·79	34·27	27·35	2·57	—	—	29·5	4·82	**N 70 B**	146–0	2324	2344	KT
		780[1]	—	2·80	34·41	27·45	2·87	—	—	39·8	4·13	**N 100 B**				
		980[1]	974	2·58	34·49	27·53	2·87	—	—	50·1	3·77	**N 70 B**	490–190	2324	2354	DGP
		1470[1]	—	2·26	34·66	27·70	2·74	—	—	60·0	3·62	**N 100 B**				
		1960[1]	1958	2·00	34·74	27·79	2·70	—	—	66·0	3·79					
		2480[2]	2480	1·63	34·74	27·82	2·87	—	—	76·8	3·88					
		2970[2]	—	1·32	34·74	27·84	2·57	—	—	84·7	4·03					
		3470[2]	3460	1·00	34·73	27·85	2·57	—	—	88·8	4·10					
		3960[2]	—	0·68	34·73	27·87	2·32	—	—	99·1	4·36					
		4460[2]	4460	0·56	34·72	27·87	2·57	—	—	104·1	4·43					
1227	0	0	—	4·13	34·10	27·08	1·56	—	0·19	10·0	6·83	**N 50 V**	100–0	0907		
		5	—	4·12	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	4·11	34·10	27·08	1·46	—	0·18	9·9	—	,,	100–50			
		20	—	4·11	34·13	27·10	1·52	—	0·17	10·3	6·93	,,	250–100			
		30	—	4·11	34·13	27·10	1·46	—	0·19	10·1	—	,,	500–250			
		40	—	4·10	34·13	27·10	1·54	—	0·19	10·9	6·91	,,	750–500			
		50	—	4·08	34·13	27·10	1·41	—	0·19	9·5	—	,,	1000–750	—	1028	
		60	—	4·01	34·13	27·11	1·43	—	0·19	10·3	6·86	**NHP**	50–0	1010	1015	
		80	—	3·97	34·13	27·12	1·44	—	0·18	10·7	—	**CWS**	0			
		100	—	3·78	34·12	27·13	1·48	—	0·17	11·6	6·79	,,	5			
		150	—	3·24	34·11	27·18	1·60	—	0·19	13·3	6·77	,,	10			
		200	—	3·09	34·09	27·17	1·62	—	0·34	15·6	6·68	,,	20			
		300	—	2·99	34·12	27·21	1·65	—	0·00	18·3	6·36	,,	50			
		400	—	2·80	34·14	27·25	1·81	—	0·00	19·8	6·10	,,	100			
		590[1]	601	2·82	34·23	27·31	2·09	—	—	29·5	4·89	**N 70 B**	77–0	1048	1108	KT
		790[1]	—	2·86	34·39	27·44	2·34	—	—	40·0	4·04	**N 100 B**				
		990[1]	983	2·56	34·47	27·52	2·40	—	—	48·9	3·80	**N 70 B**	300–160	1048	1118	DGP
		1480[1]	—	2·28	34·64	27·69	2·34	—	—	53·4	3·65	**N 100 B**				
		1970[1]	1969	2·02	34·73	27·78	2·28	—	—	67·1	3·82					
1228	1	0	—	5·59	34·23	27·02	1·37	—	0·19	10·0	6·67	**N 50 V**	100–0	2010		
		5	—	5·59	—	—	—	—	—	—	—	**N 70 V**	50–0			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1228 *cont.*	56° 39′ S, 78° 31·7′ W	1933 17 xii											
1229	55° 11·3′ S, 78° 29·6′ W	18 xii	0900	4195*	—	0–1	—	1	0	1009·5	7·7	7·3	low WSW swell
1230	6·7 miles N 62° W from Dungeness Light, Magellan Strait	23 xii	2158	27*	NE	14	NE	3	c	1003·4	8·9	8·7	low NE swell
1231	52° 28·5′ S, 65° 10·3′ W	24 xii	1000	135*	N × E	15	N × E	3	c	1002·7	8·8	8·6	mod. N × E swell
1232	52° 31·7′ S, 62° 09·7′ W	24 xii	2200	304*	N × E	16	N × E	3	0	1002·3	8·3	8·3	mod. N × E swell
1233	55° 23·6′ S, 60° 08·7′ W	28–29 xii	2000 0059	4274* —	W × S W × S	12 12	WSW W × S	3 4	or 0	988·6 988·2	5·0 4·6	4·8 4·1	low WSW swell mod. WSW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1228	1	10	—	5·58	34·23	27·02	1·37	—	0·18	9·2	—	**N 70 V**	100–50			
cont.		20	—	5·58	34·23	27·02	1·37	—	0·18	8·7	6·69	,,	250–100			
		30	—	5·56	34·23	27·02	1·31	—	0·17	8·8	—	,,	500–250			
		40	—	5·46	34·23	27·04	1·37	—	0·18	8·5	6·70	,,	750–500			
		50	—	5·35	34·23	27·05	1·43	—	0·16	9·2	—	,,	1000–750	—	**2131**	
		60	—	5·28	34·23	27·06	1·37	—	0·16	9·0	6·70	**NHP**	50–0	**2115**	**2120**	
		80	—	5·15	34·23	27·07	1·33	—	0·14	9·2	—	**CWS**	0			
		100	—	4·96	34·23	27·10	1·39	—	0·14	9·7	6·61	,,	5			
		150	—	4·80	34·23	27·11	1·44	—	0·23	9·8	6·50	,,	10			
		200	—	4·68	34·23	27·13	1·44	—	0·00	9·9	6·44	,,	20			
		300	—	4·65	34·22	27·11	1·46	—	0·00	10·3	6·39	,,	50			
		400	—	4·55	34·23	27·14	1·46	—	0·00	18·8	6·36	,,	100			
		590^1	587	4·29	34·23	27·17	1·54	—	—	14·1	6·11	**N 70 B**	119–0	**2313**	**2333**	KT
		790^1	—	3·89	34·24	27·22	2·11	—	—	22·3	5·21	**N 100 B**				
		990^1	—	3·51	34·36	27·35	2·30	—	—	32·7	4·34	**N 70 B**	410–190	**2313**	**2343**	DGP
		1480^1	—	2·53	34·50	27·55	2·66	—	—	54·8	3·72	**N 100 B**				
		1980^1	1985	2·27	34·66	27·70	2·38	—	—	63·9	3·65					
		2490^2	2508	1·93	34·72	27·77	2·51	—	—	76·7	3·74					
		2990^2	—	1·59	34·73	27·81	2·43	—	—	84·7	3·92					
		3490^2	3490	1·25	34·73	27·83	2·43	—	—	91·3	4·03					
		3990^2	—	0·87	34·72	27·85	2·51	—	—	95·9	4·30					
		4490^2	4477	0·64	34·71	27·86	2·53	—	—	110·8	4·42					
1229	1	0	—	6·50	34·15	26·85	1·20	—	0·21	—	6·75	**N 50 V**	100–0	0907		
		5	—	6·38	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	6·33	34·15	26·87	1·24	—	0·20	—	—	,,	100–50			
		20	—	6·30	34·15	26·87	1·27	—	0·21	<5·0	6·80	,,	250–100			
		30	—	6·17	34·15	26·89	1·29	—	0·19	<5·0	—	,,	500–250			
		40	—	6·02	34·16	26·91	1·48	—	0·20	—	6·71	,,	750–500			
		50	—	5·85	34·16	26·93	1·29	—	0·19	<5·0	—	,,	1000–750	—	1029	
		60	—	5·77	34·17	26·95	1·43	—	0·16	<5·0	6·70	**NHP**	50–0	1015	1020	
		80	—	5·29	34·17	27·01	1·54	—	0·15	6·4	—	**CWS**	0			
		100	—	5·18	34·19	27·04	1·43	—	0·14	8·7	6·54	,,	5			
		150	—	5·02	34·20	27·06	1·58	—	0·06	10·2	6·24	,,	10			
		200	—	4·97	34·22	27·07	1·50	—	0·00	10·2	6·20	,,	20			
		300	—	4·81	34·22	27·09	1·43	—	0·00	8·2	6·34	,,	50			
		395	—	4·68	34·21	27·11	1·41	—	0·00	8·7	6·36	,,	100			
		590^1	592	4·46	34·22	27·13	1·63	—	—	13·9	5·83	**N 70 B**	104–0	1147	1207	KT
		790^1	784	3·95	34·23	27·21	1·96	—	—	20·6	4·96	**N 100 B**				
		990^1	—	3·42	34·32	27·33	2·32	—	—	33·4	4·30	**N 70 B**	350–170	1147	1217	DGP
		1480^1	1484	2·60	34·37	27·44	2·20	—	—	39·4	4·08	**N 100 B**				
		1960^2	1957	2·22	34·66	27·70	2·72	—	—	61·6	3·05					
		2450^2	—	1·92	34·69	27·74	2·64	—	—	70·4	3·18					
		2940^2	2936	1·78	34·70	27·78	2·51	—	—	81·9	3·56					
		3430^2	—	1·44	34·72	27·81	2·45	—	—	99·3	4·06					
		3920^2	3916	0·95	34·71	27·84	2·51	—	—	100·3	4·19					
1230	7	0	—	8·40	32·63	25·38	—	—	—	—	—	**BNR**	27	**2208**	**2223**	+4 hours
1231	8	0	—	7·20	33·59	26·31	—	—	—	—	—	**N 70 B**	130–0	1009	1029	Depth of nets estimated
												N 100 B				
												N 50 V	100–0	1036		
												NHP	50–0	—	1049	
1232	8	0	—	7·70	33·85	26·44	—	—	—	—	—	**N 50 V**	100–0	**2201**		
												NHP	50–0	—	**2219**	
												N 70 B	113–0	**2224**	**2244**	KT
												N 100 B				
1233	12	0	—	4·76	34·13	27·03	1·39	—	0·21	7·9	7·00	**N 70 V**	50–0	**2007**		+5 hours
		5	—	4·75	—	—	—	—	—	—	—	,,	100–50			
		10	—	4·74	34·13	27·03	1·39	—	0·19	6·5	—	,,	250–0			
		20	—	4·43	—	—	1·41	—	0·19	6·6	7·06	,,	250–100			
		30	—	3·94	34·12	27·12	1·41	—	0·18	6·6	—	,,	500–250			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1233 *cont.*	55° 23·6′ S, 60° 08·7′ W	1933 28–29 xii											
1234	58° 12·6′ S, 62° 21·5′ W	29–30 xii	2000	3411*	NW × N	10	W × N	3	o	983·8	5·1	4·4	mod. W × N swell
1235	60° 46·6′ S, 65° 30·6′ W	30 xii	2000	3164*	NNW	10	WNW	2	bc	980·7	2·3	1·9	heavy W swell
1236	63° 29·1′ S, 69° 40·9′ W	31 xii	2000	3740*	Var.	4	S	2	om	983·4	1·8	1·2	mod. SW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp °C.	S ‰	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
1233 *cont.*	12	40	—	3·15	34·08	27·16	1·65	—	0·18	8·7	7·18	N 70 V	750–500			
		50	—	2·73	34·06	27·18	1·73	—	0·16	12·2	—	,,	1000–560	—	0002	
		60	—	2·68	34·06	27·19	1·65	—	0·18	13·8	7·19	NHP	50–0	2135	2140	
		80	—	2·61	34·05	27·18	1·67	—	0·18	13·3	—	CWS	0			
		100	—	2·59	34·08	27·21	1·71	—	0·17	14·2	7·14	,,	5			
		145	—	2·42	34·08	27·23	1·81	—	0·17	15·1	7·06	,,	10			
		190	—	2·24	34·09	27·24	1·96	—	0·15	18·5	6·81	,,	20			
		285	—	1·95	34·09	27·27	1·96	—	0·09	21·0	6·46	,,	50			
		380	—	1·88	34·13	27·30	2·17	—	0·00	28·7	5·96	,,	100			
		570^1	574	2·52	34·28	27·38	2·17	—	—	37·2	4·64	N 70 B	113–0	0010	0031	KT
		760^1	757	2·52	34·42	27·48	2·47	—	—	48·6	3·88	N 100 B				
		950^1	—	2·46	34·51	27·56	2·47	—	—	61·8	3·76	N 70 B	440–190	0010	0042	DGP
		1430^1	1437	2·18	34·68	27·72	2·41	—	—	68·6	3·69	N 100 B				
		1930^2	1932	1·89	34·73	27·79	2·30	—	—	73·8	3·66	N 50 V	100–0	0049	0058	
		2410^2	—	1·60	34·73	27·81	1·96	—	—	82·6	3·82					
		2890^2	2891	1·22	34·72	27·83	2·11	—	—	91·8	4·02					
		3370^2	—	0·93	34·71	27·85	2·22	—	—	96·9	4·22					
		3850^2	3847	0·86	34·70	27·84	2·43	—	—	101·7	4·09					
1234	13	0	—	2·83	33·99	27·12	1·56	—	0·24	7·8	7·25	N 50 V	100–0	2007		+6 hours
		5	—	2·83	—	—	—	—	—	—	—	N 70 V	50–0			
		10	—	2·83	33·99	27·12	1·54	—	0·22	8·9	—	,,	100–50			
		20	—	2·24	33·99	27·17	1·56	—	0·21	9·1	7·29	,,	250–85			
		30	—	1·94	33·98	27·19	1·65	—	0·19	10·8	—	,,	500–250			
		40	—	1·74	33·96	27·18	1·69	—	0·18	13·0	7·38	,,	750–500			
		50	—	1·72	33·96	27·18	1·69	—	0·18	11·0	—	,,	1000–750	—	2310	
		60	—	1·99	34·00	27·19	1·73	—	0·17	11·7	7·27	NHP	50–0	2130	2140	
		80	—	2·14	34·02	27·20	1·71	—	0·17	16·4	—	CWS	0			
		100	—	2·01	34·03	27·22	1·77	—	0·17	17·7	7·11	,,	5			
		150	—	1·90	34·09	27·27	1·75	—	0·14	18·0	6·71	,,	10			
		200	—	1·60	34·09	27·29	1·86	—	0·18	21·0	6·74	,,	20			
		300	—	2·15	34·18	27·33	2·11	—	0·00	29·4	5·59	,,	50			
		400	—	2·59	34·28	27·37	2·40	—	0·00	37·0	4·76	,,	100			
		600^1	—	2·32	34·42	27·49	2·64	—	—	49·1	4·04	,,	400			
		800^1	810	2·37	34·54	27·60	2·70	—	—	57·7	3·71	N 70 B	100–0	2332	2352	KT
		970^2	989	2·31	34·62	27·67	2·76	—	—	61·3	3·55	N 100 B				
		1450^2	—	2·02	34·73	27·78	2·53	—	—	68·0	3·62	N 70 B	340–210	2332	0006	DGP
		1940^2	—	1·72	34·73	27·80	2·40	—	—	73·2	3·85	N 100 B				
		2420^2	—	1·35	34·72	27·82	2·64	—	—	78·3	4·09					
		2910^2	2890	1·03	34·72	27·84	2·62	—	—	86·6	4·22					
1235	14	0	—	1·18	33·89	27·16	1·43	—	0·20	15·7	7·62	N 50 V	100–0	2005		
		5	—	1·18	—	—	—	—	—	—	—	N 70 V	50–0			
		10	—	1·17	33·90	27·17	1·52	—	0·19	18·3	—	,,	100–50			
		20	—	1·09	33·91	27·19	1·50	—	0·18	17·4	7·67	,,	250–100			
		30	—	0·71	33·91	27·21	1·73	—	0·17	19·1	—	,,	500–250			
		40	—	0·19	33·92	27·25	1·67	—	0·13	20·8	7·82	,,	750–500			
		50	—	0·10	33·93	27·25	1·65	—	0·13	20·9	—	,,	1000–750	—	2133	
		60	—	0·05	33·95	27·28	1·67	—	0·14	21·0	7·81	NHP	50–0	2135	2140	
		80	—	−0·01	33·95	27·28	1·73	—	0·13	23·0	—	CWS	0			
		100	—	−0·31	33·95	27·30	1·90	—	0·19	24·6	7·62	,,	5			
		150	—	−0·59	34·06	27·40	2·36	—	0·18	30·2	6·78	,,	10			
		200	—	1·21	34·27	27·47	2·53	—	0·00	42·6	5·14	,,	20			
		300	—	1·72	34·44	27·57	2·62	—	0·00	51·7	4·33	,,	50			
		400	—	2·00	34·53	27·62	2·57	—	0·00	58·4	3·97	,,	100			
		600^1	—	2·08	34·64	27·70	2·57	—	—	62·6	3·76	,,	400			
		800^1	805	2·02	34·69	27·74	2·53	—	—	67·9	3·83	N 70 B	153–0	2218	2238	KT
		990^1	—	1·91	34·73	27·79	2·53	—	—	69·3	3·93	N 100 B				
		1480^2	1481	1·55	34·73	27·81	2·47	—	—	74·7	4·00	N 70 B	450–220	2218	2249	DGP
		1980^2	—	1·22	34·72	27·83	2·45	—	—	80·0	4·22	N 100 B				
		2470^2	—	0·88	34·71	27·85	2·45	—	—	86·2	4·26					
		2960^2	2964	0·65	34·71	27·86	2·53	—	—	100·7	4·37					
1236	15	0	—	1·65	33·93	27·16	1·67	—	0·13	23·6	7·60	N 50 V	100–0	2005		
		5	—	1·51	—	—	—	—	—	—	—	N 70 V	50–0			
		10	—	1·31	33·93	27·18	1·63	—	0·14	25·3	—	,,	100–50			
		20	—	1·03	33·95	27·22	1·73	—	0·12	24·9	7·71	,,	250–100			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1236 *cont.*	63° 29·1 S, 69° 40·9′ W	1933 31 xii											
1237	66° 06·4′ S, 74° 25·4′ W	1934 1 i	2000	3811*	N×W	4	N×W	2	bc	991·7	0·9	−0·1	low W swell
1238	67° 29·1′ S, 77° 05′ W	2 i	0900	3237*	NE	17	NE	3	ome	987·3	0·0	−0·1	mod. NE swell
1239	66° 39·3′ S, 79° 36·7′ W	2 i	2000	4061*	NE×E	12	NE	3	osp	976·7	0·8	0·5	mod. NE swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1236 *cont.*	15	30	—	0·30	33·95	27·26	1·71	—	0·12	25·4	—	**N 70 V**	500–250			
		40	—	0·04	33·95	27·28	1·77	—	0·11	24·5	7·89	,,	750–500			
		50	—	0·00	33·95	27·28	1·77	—	0·09	24·2	—	,,	1000–750	—	**2132**	
		60	—	−0·10	33·95	27·29	1·81	—	0·08	26·6	7·77	**NHP**	50–0	**2136**	**2141**	
		80	—	−0·27	33·96	27·30	1·84	—	0·09	26·0	—	**CWS**	0			
		100	—	0·07	34·14	27·44	2·32	—	0·10	39·0	6·08	,,	5			
		150	—	1·36	34·33	27·50	2·57	—	0·06	46·3	4·88	,,	10			
		200	—	1·79	34·44	27·57	2·55	—	0·00	54·5	4·32	,,	20			
		300	—	2·01	34·53	27·62	2·60	—	0·00	57·7	3·99	,,	50			
		400	—	2·05	34·61	27·69	2·81	—	0·00	65·2	3·87	,,	100			
		590^1	583	2·01	34·65	27·71	2·55	—	—	69·0	3·80	,,	400			
		790^1	—	1·95	34·70	27·76	2·51	—	—	78·0	3·93	**N 70 B**	101–0	**2215**	**2235**	KT
		990^1	997	1·79	34·72	27·78	2·47	—	—	81·7	4·00	**N 100 B**				
		1470^2	1471	1·41	34·73	27·82	2·51	—	—	85·7	4·07	**N 70 B**	340–170	**2215**	**2242**	DGP
		1950^2	—	1·09	34·72	27·83	2·57	—	—	90·7	4·28	**N 100 B**				
		2440^2	—	0·81	34·71	27·85	2·76	—	—	98·9	4·39					
		2930^2	—	0·55	34·71	27·87	2·60	—	—	105·1	4·55					
		3420^2	3414	0·43	34·71	27·88	2·64	—	—	117·2	4·48					
1237	16	0	—	1·01	33·77	27·07	1·65	—	0·18	27·4	7·54	**N 50 V**	100–0	2004		
		5	—	1·01	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·88	33·77	27·08	1·65	—	0·18	25·6	—	,,	100–50			
		20	—	0·54	33·96	27·26	1·67	—	0·14	25·9	7·65	,,	250–100			
		30	—	0·14	33·94	27·26	1·69	—	0·12	26·2	—	,,	500–250			
		40	—	−0·28	33·92	27·27	1·75	—	0·11	26·9	7·75	,,	750–500			
		50	—	−0·73	33·94	27·30	1·82	—	0·14	26·6	—	,,	1000–750	—	2208	
		60	—	−0·88	33·94	27·31	1·96	—	0·12	27·1	7·68	**NHP**	50–0	2211	2216	
		80	—	−1·39	34·01	27·39	2·00	—	0·13	30·8	—	**CWS**	0			
		100	—	−0·92	34·10	27·44	2·22	—	0·18	32·3	6·59	,,	5			
		150	—	1·12	34·42	27·58	2·45	—	0·04	50·2	4·70	,,	10			
		200	—	1·58	34·51	27·63	2·45	—	0·00	57·5	4·24	,,	20			
		300	—	1·94	34·60	27·67	2·49	—	0·00	62·1	3·96	,,	50			
		400	—	2·05	34·65	27·71	2·43	—	0·00	67·3	3·88	,,	100			
		600^1	593	1·92	34·70	27·76	2·43	—	—	73·9	3·80	,,	400			
		800^1	—	1·82	34·73	27·79	2·36	—	—	79·8	3·93	**N 70 B**	100–0	2245	**2305**	KT
		1000^1	1005	1·60	34·73	27·81	2·24	—	—	83·8	3·98	**N 100 B**				
		1490^2	1502	1·24	34·73	27·83	2·41	—	—	91·3	4·22	**N 70 B**	290–180	2245	**2315**	DGP
		1990^2	—	0·97	34·72	27·84	2·45	—	—	96·7	4·33	**N 100 B**				
		2490^2	2483	0·69	34·71	27·86	2·53	—	—	106·4	4·35					
		2990^2	—	0·49	34·70	27·86	2·51	—	—	111·1	4·56					
		3490^2	3241?	0·39	34·70	27·87	2·64	—	—	116·5	4·56					
1238	17	0	—	−1·40	33·02	26·58	1·63	—	0·20	32·8	7·62	**N 50 V**	100–0	0905		+7 hours
												NHP	50–0	—	0927	
												N 70 B	110–0	0945	1005	KT
												N 100 B				
												N 70 B	340–210	0945	1015	DGP
												N 100 B				
1239	17	0	—	−0·88	33·20	26·72	1·79	—	0·18	25·7	7·33	**N 50 V**	100–0	2003		
		5	—	−0·88	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·89	33·20	26·72	1·79	—	0·18	27·8	—	,,	100–50			
		20	—	−1·47	33·51	26·99	1·79	—	0·14	28·0	7·72	,,	250–100			
		30	—	−0·97	33·64	27·07	1·81	—	0·15	27·9	—	,,	500–250			
		40	—	−1·00	33·76	27·17	1·77	—	0·15	26·9	7·76	,,	750–500			
		50	—	−1·47	33·79	27·22	2·01	—	0·17	29·3	—	,,	1000–750	—	2126	
		60	—	−1·59	33·90	27·30	2·05	—	0·18	30·4	7·21	**NHP**	50–0	2126	2130	
		80	—	−1·56	34·03	27·41	2·15	—	0·21	31·2	—	**CWS**	0			
		100	—	−0·30	34·19	27·50	2·40	—	0·12	36·7	6·06	,,	5			
		150	—	1·40	34·45	27·59	2·57	—	0·04	52·0	4·42	,,	10			
		200	—	1·64	34·53	27·65	2·64	—	0·00	57·2	4·16	,,	20			
		300	—	1·73	34·60	27·69	2·53	—	0·00	61·3	4·11	,,	50			
		400	—	1·81	34·65	27·72	2·53	—	0·00	66·5	3·93	,,	100			
		600^1	591	1·85	34·70	27·77	2·59	—	—	71·3	3·85	,,	400			
		800^1	—	1·76	34·73	27·80	2·53	—	—	75·3	3·91	**N 70 B**	122–0	**2317**	**2337**	KT
		1000^1	—	1·62	34·73	27·81	2·43	—	—	79·4	4·01	**N 100 B**				
		1500^1	1505	1·23	34·73	27·84	2·43	—	—	84·8	4·06	**N 70 B**	400–195	**2317**	**2349**	DGP
		1990^2	1987	0·98	34·72	27·84	2·51	—	—	89·1	4·32	**N 100 B**				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1239 *cont.*	66° 39·3′ S, 79° 36·7′ W	1934 2 i											
1240	65° 59·5′ S, 82° 37·5′ W	3 i	0900	4402*	N	16	N	4	o	975·1	1·1	0·7	low N swell
1241	65° 12·9′ S, 85° 59·7′ W	3–4 i	2000	4543*	NNE	8	NW	2	c	974·6	1·4	0·7	mod. conf. NW and NE swells
			0007	—	NNE	6	NNE	3	osm	973·3	0·6	0·3	mod. conf. WSW and NW swells
1242	66° 16·2′ S, 88° 31·3′ W	4 i	0900	4530*	N×E	2	N×E	2	c	975·5	2·5	0·9	low WNW swell
1243	67° 28′ S, 91° 24·1′ W	4 i	2000	4503*	—	0	—	0	os	975·5	−0·6	−0·8	mod. NW swell
1244	68° 36·6′ S, 94° 22·9′ W	5 i	0900	4389*	NNW	5	NNW	2	c	975·5	0·2	−0·2	low NNW swell

		HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				
							Mg.—atom m.^{3}							TIME		
Station	Age of moon (days)	Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	Remarks
1239 *cont.*	17	2490^2	—	0·71	34·71	27·86	2·40	—	—	94·0	4·44					
		2980^2	2981	0·50	34·71	27·87	2·53	—	—	97·7	4·49					
		3480^2	—	0·38	34·71	27·88	2·60	—	—	105·3	4·47					
		3980^2	3979	0·27	34·70	27·88	2·64	—	—	113·6	4·58					
1240	17	0	—	0·65	33·77	27·10	—	—	—	—	—	**N 50 V**	100–0	0904		
												NHP	50–0	—	0919	
												N 70 B **N 100 B**	153–0	0928	0948	KT
1241	18	0	—	1·41	33·88	27·15	1·52	—	0·21	12·1	7·42	**N 50 V**	100–0	2003		
		5	—	1·41	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	1·32	33·90	27·16	1·54	—	0·21	11·7	—	,,	100–50			
		20	—	1·20	33·90	27·17	1·60	—	0·21	12·0	7·46	,,	250–100			
		30	—	1·11	33·90	27·18	1·63	—	0·21	11·7	—	,,	500–250			
		40	—	1·00	33·90	27·18	1·56	—	0·19	11·8	7·53	,,	750–500			
		50	—	0·63	33·91	27·22	1·63	—	0·18	11·4	—	,,	1000–750	—	**2210**	
		60	—	0·54	33·91	27·22	1·67	—	0·17	11·5	7·57	**NHP**	50–0	**2211**	**2216**	
		80	—	0·49	33·91	27·22	1·67	—	0·17	12·7	—	**CWS**	0			
		100	—	0·29	33·91	27·23	1·62	—	0·17	(13·3)	7·51	,,	5			
		150	—	−0·20	33·97	27·31	1·84	—	0·15	14·2	7·34	,,	10			
		195	—	0·31	34·00	27·30	2·05	—	0·00	16·2	6·92	,,	20			
		295	—	1·74	34·20	27·37	2·38	—	0·00	18·3	5·32	,,	50			
		390	—	2·07	34·31	27·44	2·47	—	0·00	28·2	4·60	,,	100			
		590^1	581	2·13	34·50	27·58	2·60	—	—	35·4	3·84	,,	400			
		780^1	—	2·18	34·58	27·64	2·53	—	—	49·9	3·65	**N 70 B**	119–0	**2323**	**2343**	KT
		980^1	978	2·12	34·64	27·70	2·43	—	—	51·2	3·72	**N 100 B**				
		1470^1	—	1·86	34·73	27·79	2·40	—	—	55·1	3·92	**N 70 B**	405–210	**2323**	**2353**	DGP
		1960^1	1963	1·49	34·72	27·81	2·32	—	—	60·1	4·06	**N 100 B**				
		2420^2	2437	1·18	34·71	27·83	2·43	—	—	67·3	4·10					
		2920^2	—	0·89	34·71	27·85	2·51	—	—	80·9	4·21					
		3410^2	3404	0·64	34·70	27·85	2·53	—	—	80·5	4·31					
		3910^2	—	0·47	34·70	27·86	2·49	—	—	80·4	4·50					
		4300^2	4312	0·38	34·70	27·87	2·49	—	—	84·7	4·45					
1242	18	0	—	1·00	33·83	27·13	—	—	—	—	—	**N 50 V**	100–0	0903		
												NHP	50–0	—	0919	
												N 70 B **N 100 B**	170–0	0929	0949	KT
1243	19	0	—	0·81	33·82	27·14	1·77	—	0·24	15·8	7·73	**N 50 V**	100–0	2006		
		5	—	0·81	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·21	33·82	27·17	1·69	—	0·23	12·9	—	,,	100–50			
		20	—	0·10	33·82	27·17	1·84	—	0·22	13·6	7·86	,,	250–100			
		30	—	0·08	33·82	27·18	1·86	—	0·21	12·0	—	,,	500–250			
		40	—	−0·02	33·82	27·18	1·86	—	0·21	11·7	7·86	,,	750–500			
		50	—	−0·07	33·82	27·18	1·82	—	0·21	11·9	—	,,	1000–750	—	2118	
		60	—	−0·23	33·83	27·20	1·96	—	0·21	11·8	7·77	**NHP**	50–0	2120	2125	
		80	—	−0·93	33·86	27·24	2·15	—	0·19	14·8	—	**CWS**	0			
		100	—	−1·43	33·91	27·31	2·26	—	0·18	18·7	7·51	,,	5			
		150	—	0·16	34·14	27·43	2·45	—	0·00	29·4	6·17	,,	10			
		200	—	1·24	34·32	27·51	2·72	—	0·00	41·6	5·18	,,	20			
		300	—	1·93	34·47	27·58	2·72	—	0·00	42·1	4·23	,,	50			
		400	—	2·05	34·54	27·63	2·72	—	0·00	50·7	3·95	,,	100			
		590^1	599	2·10	34·62	27·69	2·79	—	—	55·4	3·76	,,	400			
		790^1	783	1·98	34·69	27·74	2·64	—	—	55·5	3·78	**N 70 B**	96–0	2249	**2311**	KT
		990^1	—	1·89	34·73	27·79	2·64	—	—	61·6	3·93	**N 100 B**				
		1480^1	1485	1·51	34·73	27·82	2·60	—	—	66·8	4·13	**N 70 B**	325–220	2249	**2323**	DGP
		2000^2	1999	1·18	34·73	27·84	2·62	—	—	76·0	4·17	**N 100 B**				
		2500^2	—	0·89	34·72	27·85	2·68	—	—	86·1	4·36					
		2990^2	2995	0·63	34·71	27·86	2·76	—	—	90·8	4·44					
		3490^2	—	0·46	34·70	27·86	2·81	—	—	97·3	4·41					
		3990^2	3991	0·34	34·70	27·87	2·78	—	—	100·0	4·57					
1244	20	0	—	0·12	33·52	26·93	—	—	—	—	—	**N 50 V**	100–0	0906		
												NHP	50–0	—	0918	
												N 70 B **N 100 B**	155–0	0925	0945	KT

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1245	69° 16·4′ S, 98° 09·7′ W	1934 5 i	2000	4418*	NW × N	5	NNW	2	c	980·9	−0·6	−0·8	no swell
1246	68° 11·9′ S, 101° 15·1′ W	6 i	0907	4535*	SE × S	15	SE × S	3	os	982·9	−0·3	−0·3	low SE × S swell
1247	66° 59·2′ S, 104° 18·2′ W	6–7 i	2000	4733*	S × W	15	S × W	3	c	988·7	−0·6	−0·6	mod. S × W swell
			0000	—	S × W	15	S × W	3	o	988·8	−0·6	−0·6	mod. S × W swell
			0400	—	S × W	15	S × W	3	c	991·1	−0·1	−0·3	mod. S × W swell
1248	66° 15·5′ S, 106° 22′ W	7 i	1030	4852*	WSW	13	WSW	3	c	994·2	0·3	0·3	mod. WSW swell
1249	67° 11·9′ S, 108° 41·5′ W	7 i	2000	4492*	NW	4	NW	2	c	994·6	−0·7	−0·9	mod. SW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S °/₀₀	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
1245	20	0	—	−0·40	33·43	26·89	1·56	—	0·18	16·1	7·83	**N 50 V**	100–0	2008		
		5	—	−0·40	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·40	33·43	26·89	1·58	—	0·18	15·5	—	,,	100–50			
		20	—	−0·63	33·73	27·13	1·67	—	0·15	16·3	7·99	,,	250–100			
		30	—	−0·73	33·82	27·21	1·79	—	0·14	18·2	—	,,	500–250			
		40	—	−1·43	33·92	27·32	2·01	—	0·15	21·5	7·45	,,	750–500			
		50	—	−1·58	33·96	27·35	2·15	—	0·17	22·5	—	,,	1000–750	—	2119	
		60	—	−1·60	33·97	27·36	2·28	—	0·18	22·2	7·18	**NHP**	50–0	2122	2126	
		80	—	−1·42	34·05	27·42	2·28	—	0·18	21·9	—	**CWS**	0			
		100	—	−0·87	34·13	27·46	2·32	—	0·12	31·2	6·44	,,	5			
		150	—	0·99	34·36	27·55	2·66	—	0·00	42·1	4·91	,,	10			
		200	—	1·60	34·46	27·59	2·66	—	0·00	48·0	4·27	,,	20			
		300	—	1·94	34·60	27·67	2·72	—	0·00	49·0	3·96	,,	50			
		395	—	2·05	34·62	27·70	2·72	—	0·00	52·0	3·91	,,	100			
		590[1]	585	1·93	34·70	27·76	2·72	—	—	54·7	3·90	,,	400			
		790[1]	785	1·79	34·71	27·78	2·72	—	—	55·2	3·96	**N 70 B**	108–0	2258	2318	KT
		980[1]	—	1·68	34·72	27·79	2·68	—	—	59·3	4·06	**N 100 B**				
		1470[1]	1481	1·29	34·71	27·82	2·72	—	—	64·4	4·19	**N 70 B**	390–200	2258	2329	DGP
		2000[2]	2008	0·96	34·70	27·83	2·72	—	—	79·8	4·14	**N 100 B**				
		2500[2]	—	0·73	34·70	27·85	2·72	—	—	80·9	4·26	**N 100 H**	0–5	2258	2331	
		2990[2]	2992	0·48	34·70	27·86	2·79	—	—	88·8	4·32					
		3490[2]	—	0·40	34·69	27·85	2·81	—	—	91·0	4·44					
		3990[2]	3987	0·31	34·69	27·85	2·81	—	—	94·0	4·50					
1246	21	0	—	0·01	33·72	27·10	—	—	—	—	—	**N 50 V**	100–0	0912		
												NHP	50–0	—	0926	
												N 70 B	69–0	0931	0951	KT
												N 100 B				
1247	21	0	—	−0·10	33·68	27·07	1·71	—	0·24	15·7	7·80	**N 50 V**	100–0	2008		
		5	—	−0·10	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·10	33·68	27·07	1·75	—	0·24	15·3	—	,,	100–50			
		20	—	−0·10	33·68	27·07	1·81	—	0·24	15·0	7·80	,,	250–100			
		30	—	−0·13	33·70	27·09	1·79	—	0·24	14·6	—	,,	500–250			
		40	—	−0·48	33·72	27·12	1·75	—	0·23	14·9	7·86	,,	750–500			
		50	—	−0·53	33·73	27·12	1·81	—	0·22	15·3	—	,,	1000–750	—	2123	
		60	—	−0·57	33·74	27·14	1·79	—	0·22	15·5	7·77	**NHP**	50–0	2126	2131	
		80	—	−1·61	33·89	27·29	2·11	—	0·25	22·0	—	**CWS**	0			
		100	—	−1·37	33·95	27·33	2·11	—	0·09	21·9	7·30	,,	5			
		150	—	0·42	34·15	27·43	2·38	—	0·00	26·9	6·08	,,	10			
		200	—	1·62	34·32	27·48	2·55	—	0·00	35·4	5·06	,,	20			
		300	—	1·92	34·44	27·56	2·68	—	0·00	42·1	4·41	,,	50			
		400	—	2·15	34·52	27·60	2·68	—	0·00	50·1	4·01	,,	100			
		590[1]	601	2·12	34·63	27·69	2·76	—	—	56·9	3·80	,,	400			
		790[1]	—	2·07	34·69	27·73	2·68	—	—	61·0	3·85	**N 70 B**	108–0	0405	0425	KT
		990[1]	982	1·95	34·72	27·77	2·53	—	—	62·6	3·94	**N 100 B**				
		1470[2]	1467	1·64	34·73	27·81	2·62	—	—	68·6	3·94	**N 70 B**	340–180	0405	0434	DGP
		2000[3]	1999	1·25	34·73	27·83	2·62	—	—	85·7	4·12	**N 100 B**				
		2470[4]	2466	0·98	34·71	27·84	2·62	—	—	87·7	4·32					
1248	22	0	—	0·30	33·73?	27·08	—	—	—	—	—	**N 50 V**	100–0	1036		+8 hours
												NHP	50–0	—	1056	
												N 70 B	174–0	1120	1140	KT
												N 100 B				
												N 70 B	520–250	1120	1151	DGP
												N 100 B				
1249	22	0	—	0·38	33·74	27·09	1·54	—	0·24	13·0	7·73	**N 50 V**	100–0	2010		
		5	—	0·38	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·31	33·75	27·10	1·52	—	0·24	20·9	—	,,	100–50			
		20	—	0·09	33·75	27·12	1·54	—	0·24	22·1	7·79	,,	250–100			
		30	—	−0·58	33·75	27·15	1·58	—	0·22	24·4	—	,,	500–250			
		40	—	−0·69	33·75	27·15	1·67	—	0·23	24·3	7·76	,,	750–500			
		50	—	−0·73	33·76	27·16	1·75	—	0·22	25·9	—	,,	1000–750	—	2128	
		60	—	−1·37	33·84	27·24	1·82	—	0·24	27·8	7·53	**NHP**	50–0	2126	2131	
		80	—	−1·71	33·95	27·34	1·84	—	0·27	28·2	—	**CWS**	0			
		100	—	−1·70	33·98	27·37	1·88	—	0·29	30·5	7·22	,,	5			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1249 *cont.*	67° 11·9′ S, 108° 41·5′ W	1934 7 i											
1250	68° 17·8′ S, 111° 49·3′ W	8 i	0900	4140*	W	17	W	3	om	986·5	0·6	0·3	low W × S swell
1251	69° 24·6′ S, 114° 45·9′ W	8 i	2000	3912*	WSW	8	SW	2	c	989·5	−0·3	−0·6	no swell
1252	68° 30·4′ S, 116° 38·6′ W	9 i	0957	4120*	W	1	W	1	o	995·1	−0·5	−1·1	no swell
1253	67° 13·6′ S, 118° 05·8′ W	9–10 i	2000 0000	4581* —	NE × N NE	10 15	NE × N NE	3 4	om oms	987·1 980·3	−0·3 −0·6	−0·3 −0·6	mod. NW swell mod. N × E swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.^{3}				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1249 *cont.*	22	150	—	0·74	34·33	27·54	2·32	—	0·00	47·2	5·41	CWS	10			
		200	—	1·56	34·45	27·58	2·43	—	0·00	53·9	4·46	,,	20			
		300	—	1·91	34·59	27·68	2·36	—	0·00	62·1	4·05	,,	50			
		400	—	2·02	34·63	27·70	2·32	—	0·00	66·0	3·91	,,	100			
		590^1	595	1·98	34·69	27·74	2·26	—	—	69·0	3·84	,,	400			
		790^1	788	1·84	34·73	27·79	2·26	—	—	74·6	3·93	N 70 B	100–0	2312	2332	KT
		990^1	—	1·73	34·73	27·80	2·13	—	—	76·6	4·02	N 100 B				
		1480^1	1482	1·36	34·72	27·82	2·26	—	—	82·0	4·17	N 70 B	340–190	2312	2342	DGP
		1980^2	1982	1·12	34·70	27·82	2·32	—	—	89·0	4·13	N 100 B				
		2480^2	—	0·79	34·70	27·84	2·43	—	—	98·1	4·35					
		2970^2	2977	0·57	34·70	27·86	2·41	—	—	91·1	4·41					
		3470^2	—	0·38	34·70	27·87	2·41	—	—	109·4	4·45					
		3970^2	3962	0·27	34·69	27·86	2·41	—	—	114·3	4·43					
1250	23	0	—	0·29	33·69	27·05	—	—	—	—	—	N 50 V	100–0	0908		+9 hours
												NHP	50–0	—	0923	
												N 70 B N 100 B	140–0	0927	0947	KT
1251	23	0	—	−0·20	33·74	27·12	1·75	—	0·21	37·3	7·71	N 50 V	100–0	2008		
		5	—	−0·20	—	—	—	—	—	—	—	N 70 V	50–0			
		10	—	−0·30	33·74	27·12	1·77	—	0·20	41·4	—	,,	100–50			
		20	—	−0·60	33·78	27·18	1·67	—	0·16	37·4	7·73	,,	250–100			
		30	—	−0·80	33·80	27·20	1·81	—	0·16	38·1	—	,,	500–250			
		40	—	−0·88	33·82	27·22	1·98	—	0·16	40·7	7·60	,,	750–500			
		50	—	−1·03	33·86	27·24	2·03	—	0·14	45·6	—	,,	1000–750	—	2157	
		60	—	−1·22	33·98	27·36	2·22	—	0·13	45·9	6·93	NHP	50–0	2139	2144	
		80	—	−1·19	34·12	27·47	2·22	—	0·08	46·8	—	CWS	0			
		100	—	−0·60	34·26	27·56	2·22	—	0·04	47·0	5·75	,,	5			
		150	—	−0·62	34·42	27·68	2·26	—	0·00	53·7	4·99	,,	10			
		200	—	1·13	34·55	27·70	2·47	—	0·00	59·6	4·43	,,	20			
		300	—	1·78	34·67	27·75	2·55	—	0·00	67·1	4·03	,,	50			
		400	—	1·81	34·70	27·77	2·28	—	0·00	69·6	4·01	,,	100			
		590^1	586	1·71	34·73	27·80	2·28	—	—	73·8	4·02	N 70 B	95–0	2229	2249	KT
		790^1	—	1·56	34·73	27·81	2·30	—	—	76·7	4·08	N 100 B				
		990^1	1002	1·41	34·73	27·82	2·32	—	—	80·1	4·15	N 70 B	340–200	2229	2300	DGP
		1490^2	1493	1·06	34·73	27·85	2·32	—	—	87·0	4·05	N 100 B				
		1990^2	—	0·81	34·72	27·85	2·53	—	—	94·9	4·22					
		2490^2	2495	0·59	34·70	27·86	2·51	—	—	100·8	4·35					
		2990^2	—	0·40	34·70	27·87	2·49	—	—	105·2	4·36					
		3490^2	3476	0·33	34·70	27·87	2·51	—	—	114·6	4·49					
252	24	0	—	−0·70	33·44	26·90	—	—	—	—	—	N 50 V	100–0	1004		
												NHP	50–0	—	1015	
												N 70 B N 100 B	103–0	1024	1044	KT
253	24	0	—	−0·62	33·80	27·19	1·94	—	0·22	25·9	7·85	N 50 V	100–0	2008		
		5	—	−0·62	—	—	—	—	—	—	—	N 70 V	50–0			
		10	—	−0·62	33·80	27·19	2·03	—	0·23	25·1	—	,,	100–50			
		20	—	−0·62	33·81	27·20	1·96	—	0·23	24·7	7·86	,,	250–100			
		30	—	−0·80	33·83	27·23	1·98	—	0·20	27·7	—	,,	500–250			
		40	—	−0·79	33·83	27·23	2·07	—	0·20	26·4	7·83	,,	750–500			
		50	—	−0·80	33·83	27·23	2·03	—	0·19	24·8	—	,,	1000–750	—	2148	
		60	—	−0·87	33·83	27·23	2·05	—	0·19	24·9	7·80	NHP	50–0	2150	2155	
		80	—	−0·97	33·84	27·23	2·11	—	0·19	25·2	—	CWS	0			
		100	—	−1·70	33·99	27·38	2·32	—	0·29	28·1	7·29	,,	5			
		150	—	−0·59	34·15	27·48	2·49	—	0·00	37·3	6·45	,,	10			
		195	—	1·22	34·42	27·58	2·66	—	0·00	48·0	4·84	,,	20			
		295	—	1·90	34·59	27·68	2·79	—	0·00	55·1	4·05	,,	50			
		390	—	2·02	34·63	27·70	2·72	—	0·00	61·5	3·95	,,	100			
		590^1	588	1·95	34·70	27·76	2·62	—	—	67·0	3·87	N 70 B	141–0	2332	2352	KT
		780^1	—	1·83	34·74	27·80	2·62	—	—	72·3	3·98	N 100 B				
		980^1	973	1·70	34·76	27·82	2·51	—	—	74·2	4·04	N 70 B	420–210	2332	0002	DGP
		1470^1	—	1·32	34·74	27·84	2·47	—	—	79·2	4·23	N 100 B				
		1960^1	1973	1·00	34·73	27·85	2·62	—	—	89·2	4·32					
		2470^2	2452	0·74	34·72	27·86	2·62	—	—	92·5	4·21					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1253 *cont.*	67° 13·6′ S, 118° 05·8′ W	1934 9–10 i											
1254	66° 24·1′ S, 120° 41·8′ W	10 i	0900	4645*	NW × N	17	NW × N	4	ofe	971·5	0·5	−0·1	mod. NNW swell
1255	65° 38′ S, 123° 10·2′ W	10 i	2000	4809*	WNW	18	WNW	5	c	969·6	−0·1	−0·6	heavy WNW swell
1256	66° 50·7′ S, 126° 13·5′ W	11 i	0900	4541*	S	2	—	1	b	969·0	1·7	0·0	heavy conf. W swell
1257	67° 52·4′ S, 129° 27·5′ W	11 i	2000	4300*	SSW	8	SSW	2	om	978·1	−0·9	−0·9	low W × N swell
1258	68° 39·9′ S, 132° 52·1′ W	12 i	0852	4353*	SSW	19	SSW	3	o	981·8	−2·2	−2·5	low NW × N swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS					Mg.—atom m.³					BIOLOGICAL OBSERVATIONS		TIME		Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
1253 *cont.*	24	2960^2	—	0·55	34·72	27·87	2·70	—	—	98·1	4·39					
		3450^2	3455	0·38	34·72	27·88	2·70	—	—	107·7	4·50					
		3950^2	—	0·30	34·72	27·88	2·72	—	—	114·3	4·58					
		4340^2	4350	0·26	34·72	27·89	2·72	—	—	116·1	4·49					
1254	25	0	—	−0·19	33·74	27·12	—	—	—	—	—	**N 50 V**	100–0	0904		
												NHP	50–0	—	0914	
												N 70 B **N 100 B**	173–0	0924	0944	KT
1255	25	0	—	−0·18	33·68	27·07	1·96	—	0·25	24·2	7·80	**N 50 V**	100–0	2004		
		5	—	−0·18	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·18	33·68	27·07	1·90	—	0·24	26·0	—	,,	100–50			
		20	—	−0·18	33·69	27·08	1·90	—	0·25	26·0	7·80	,,	250–100			
		30	—	−0·18	33·70	27·09	1·69	—	0·24	26·0	—	,,	500–250			
		40	—	−0·17	33·70	27·09	1·77	—	0·27	25·9	7·81	,,	750–500			
		50	—	−0·21	33·71	27·10	1·79	—	0·26	26·0	—	,,	1000–750	—	2145	
		60	—	−0·50	33·72	27·12	1·82	—	0·26	28·9	7·76	**NHP**	50–0	2126	2132	
		80	—	−1·63	33·90	27·30	2·17	—	0·28	36·8	—	**CWS**	0			
		100	—	−1·60	33·98	27·37	2·17	—	0·29	37·9	7·30	,,	5			
		150	—	−0·94	34·09	27·43	2·26	—	0·00	40·9	6·78	,,	10			
		200	—	1·11	34·33	27·51	2·57	—	0·00	55·5	4·98	,,	20			
		300	—	1·71	34·51	27·62	2·70	—	0·00	59·8	4·26	,,	50			
		395	—	1·95	34·60	27·67	2·62	—	0·00	63·1	3·97	,,	100			
		590^1	601	2·02	34·69	27·74	2·60	—	—	69·2	3·84	**N 70 B** **N 100 B**	132–0	2315	2335	KT
		790^1	—	1·90	34·73	27·79	2·51	—	—	75·6	3·87					
		990^1	976	1·75	34·74	27·81	2·41	—	—	78·6	3·96	**N 70 B** **N 100 B**	350–220	2315	2345	DGP
		1480^1	—	1·39	34·76	27·84	2·57	—	—	85·6	4·21					
		1970^1	1979?	1·08	34·74	27·86	2·51	—	—	91·2	4·26					
		2470^2	2472	0·83	34·73	27·86	2·55	—	—	98·0	4·43					
		2970^2	—	0·61	34·72	27·87	2·76	—	—	101·3	4·42					
		3460^2	3463	0·41	34·72	27·88	2·59	—	—	105·8	4·49					
		3960^2	—	0·29	34·72	27·88	2·60	—	—	110·7	4·51					
		4450^2	4455	0·27	34·72	27·89	2·66	—	—	111·0	4·54					
1256	26	0	—	−0·36	33·64	27·05	—	—	—	—	—	**N 50 V**	100–0	0906		+10 hours
												NHP	50–0	—	0918	
												N 70 B **N 100 B**	117–0	0924	0944	KT
1257	26	0	—	−1·02	33·75	27·16	1·69	—	0·11	33·9	7·98	**N 50 V**	100–0	2007		
		5	—	−1·02	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·02	33·75	27·16	1·69	—	0·09	31·7	—	,,	100–50			
		20	—	−1·09	33·75	27·17	1·69	—	0·09	32·8	8·00	,,	250–100			
		30	—	−1·10	33·75	27·17	1·73	—	0·09	35·4	—	,,	500–250			
		40	—	−1·30	33·77	27·18	1·81	—	0·08	32·6	7·96	,,	750–500			
		50	—	−1·42	33·83	27·25	1·82	—	0·10	31·6	—	,,	1000–750	—	2132	
		60	—	−1·62	34·02	27·40	1·88	—	0·14	33·0	7·39	**NHP**	50–0	2133	2139	
		80	—	−1·38	34·14	27·50	1·92	—	0·21	38·6	—	**CWS**	0			
		90	—	−1·67	34·15	27·51	1·86	—	0·26	38·2	7·09	,,	5			
		140	—	1·02	34·49	27·65	2·40	—	0·00	53·1	4·65	,,	10			
		185	—	1·25	34·56	27·69	2·41	—	0·00	57·9	4·33	,,	20			
		275	—	1·74	34·66	27·74	2·45	—	0·00	61·8	4·00	,,	50			
		370	—	1·83	34·71	27·78	2·22	—	0·00	66·2	3·97	,,	100			
		550^1	546	1·75	34·73	27·80	2·32	—	—	69·6	3·96	**N 70 B** **N 100 B**	122–0	2254	2314	KT
		740^1	—	1·63	34·74	27·82	2·32	—	—	77·5	4·05					
		920^1	—	1·51	34·76	27·84	2·34	—	—	78·4	4·04	**N 70 B** **N 100 B**	440–190	2254	2325	DGP
		1380^1	1391	1·14	34·76	27·86	2·36	—	—	82·1	4·23					
		1930^2	1928	0·84	34·73	27·86	2·41	—	—	88·3	4·23					
		2410^2	—	0·63	34·72	27 86	2·47	—	—	94·9	4·23					
		2900^2	2895	0·44	34·72	27·88	2·55	—	—	102·4	4·41					
		3380^2	—	0·34	34·72	27·88	2·45	—	—	111·7	4·51					
		3860^2	3872	0·28	34·72	27·88	2·60	—	—	116·0	4·46					
1258	27	0	—	−1·25	33·65	27·09	—	—	0·13	—	—	**N 50 V**	100–0	0901		
												NHP	50–0	—	0914	
												N 70 B **N 100 B**	88–0	0943	1003	KT

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1258 *cont.*	68° 39·9′ S, 132° 52·1′ W	1934 12 i											
1259	67° 26·6′ S, 135° 53·7′ W	12 i	2000	4530*	SSW	10	SSW	2	o	985·3	−2·2	−2·8	low conf. SSW swell
1260	66° 11·9′ S, 139° 00·6′ W	13 i	0900	4087*	SW×W	13	SW	3	c	995·0	0·6	0·0	low WSW swell
1261	65° 06′ S, 141° 51·1′ W	13 i	2000	4323*	NNE	12	NNE	4	oms	987·7	−0·6	−0·6	mod. N×W swell
1262	66° 03·1′ S, 144° 39·3′ W	14 i	0900	3701*	SSW	20	SSW	4	c	995·0	−1·1	−1·7	mod. SSW swell
1263	66° 58·3′ S, 147° 21·4′ W	14 i	2006	4455*	SW	12	SW	3	c	1006·3	−1·4	−1·7	mod. SW×S swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS					Mg.—atom $m.^3$					BIOLOGICAL OBSERVATIONS		TIME		Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1258 *cont.*	27											**N 70 B**	320–130	0943	1013	DGP
												N 100 B				
												N 100 H	0–5	0943	1013	
1259	27	0	—	−1·00	33·70	27·12	1·77	—	0·21	33·8	7·89	**N 50 V**	100–0	2015		
		5	—	−1·00	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·00	33·70	27·12	1·75	—	0·21	34·6	—	,,	100–50			
		20	—	−0·96	33·71	27·13	1·69	—	0·21	33·1	7·91	,,	250–100			
		30	—	−0·96	33·71	27·13	1·77	—	0·22	32·5	—	,,	500–250			
		40	—	−0·96	33·71	27·13	1·69	—	0·22	33·1	7·88	,,	750–500			
		50	—	−0·97	33·71	27·13	1·75	—	0·21	31·7	—	,,	1000–750	—	2127	
		60	—	−1·30	33·87	27·27	2·07	—	0·26	33·9	7·64	**NHP**	50–0	2135	2139	
		80	—	−1·72	33·99	27·38	2·17	—	0·31	32·9	—	**CWS**	0			
		100	—	−1·70	34·00	27·38	2·24	—	0·26	32·7	7·34	,,	5			
		150	—	0·50	34·32	27·55	2·55	—	0·00	50·4	5·55	,,	10			
		195	—	1·41	34·48	27·62	2·57	—	0·00	61·3	4·47	,,	20			
		295	—	1·85	34·60	27·68	2·57	—	0·00	62·3	4·04	,,	50			
		385	—	1·95	34·68	27·74	2·57	—	0·00	68·1	3·96	,,	100			
		590^{1}	583	1·85	34·72	27·78	2·32	—	—	70·1	3·92	**N 70 B**	84–0	**2313**	**2333**	KT
		790^{1}	—	1·67	34·75	27·82	2·47	—	—	80·5	3·96	**N 100 B**				
		980^{1}	975	1·52	34·75	27·84	2·51	—	—	82·6	4·09	**N 70 B**	290–150	**2313**	**2343**	DGP
		1480^{1}	—	1·16	34·74	27·85	2·55	—	—	85·0	4·27	**N 100 B**				
		1970^{1}	1978	0·87	34·73	27·86	2·64	—	—	95·6	4·36	**N 100 H**	0–5	**2313**	**2343**	
		2490^{2}	2487	0·67	34·72	27·86	2·68	—	—	102·2	4·39					
		2980^{2}	—	0·46	34·72	27·87	2·68	—	—	109·4	4·41					
		3480^{2}	3472	0·31	34·72	27·88	2·57	—	—	113·5	4·48					
		3980^{2}	—	0·24	34·72	27·89	2·57	—	—	112·5	4·61					
		4380^{2}	4378	0·19	34·71	27·89	2·49	—	—	113·8	4·82					
1260	27	0	—	−0·58	33·96	27·32	—	—	—	—	—	**N 50 V**	100–0	0906	—	+11 hours
												NHP	50–0	—	0918	
												N 70 B	139–0	0925	0945	KT
												N 100 B				
1261	28	0	—	−0·36	33·88	27·25	1·69	—	0·17	32·4	7·79	**N 50 V**	100–0	2013		
		5	—	−0·37	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·37	33·88	27·25	1·65	—	0·17	36·5	—	,,	100–50			
		20	—	−0·37	33·88	27·25	1·60	—	0·17	36·4	7·82	,,	250–100			
		30	—	−0·40	33·88	27·25	1·63	—	0·18	36·8	—	,,	500–250			
		40	—	−0·44	33·88	27·25	1·73	—	0·18	37·4	7·75	,,	750–500			
		50	—	−0·45	33·88	27·25	1·69	—	0·19	36·3	—	,,	1000–750	—	**2134**	
		60	—	−0·47	33·89	27·25	1·58	—	0·19	37·6	7·75	**NHP**	50–0	**2135**	**2139**	
		80	—	−0·73	33·95	27·31	1·69	—	0·21	37·2	—	**CWS**	0			
		100	—	−1·11	34·04	27·40	1·96	—	0·22	37·2	7·07	,,	5			
		150	—	0·50	34·41	27·62	2·24	—	0·06	57·9	5·17	,,	10			
		200	—	1·65	34·64	27·74	2·24	—	0·00	67·3	4·10	,,	20			
		300	—	1·81	34·70	27·77	2·26	—	0·00	73·5	4·08	,,	50			
		395	—	1·75	34·72	27·79	2·28	—	0·00	74·6	4·11	,,	100			
		590^{1}	591	1·58	34·73	27·81	2·15	—	—	79·3	4·10	**N 70 B**	130–0	**2249**	**2309**	Depth estimated
		790^{1}	—	1·40	34·75	27·84	2·09	—	—	84·0	4·14	**N 100 B**				
		990^{1}	—	1·23	34·74	27·85	2·22	—	—	88·2	4·17	**N 70 B**	430–210	**2249**	**2319**	DGP
		1480^{1}	1484	0·92	34·73	27·86	2·32	—	—	91·5	4·32	**N 100 B**				
		1980^{2}	1915?	0·70	34·72	27·86	2·49	—	—	98·2	4·30					
		2470^{2}	—	0·49	34·72	27·87	2·32	—	—	105·4	4·41					
		2970^{2}	2968	0·32	34·72	27·88	2·60	—	—	112·4	4·60					
		3460^{2}	—	0·19	34·71	27·89	2·43	—	—	111·4	4·63					
		3950^{2}	3952	0·11	34·71	27·89	2·34	—	—	105·3	4·75					
1262	28	0	—	−0·20	33·97	27·31	—	—	—	—	—	**N 50 V**	100–0	0906		
												NHP	50–0	—	0917	
												N 70 B	151–0	0926	0946	KT
												N 100 B				
1263	29	0	—	−0·81	33·82	27·22	1·48	—	0·13	36·8	8·03	**N 50 V**	100–0	2008		
		5	—	−0·81	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·81	33·86	27·24	1·46	—	0·14	37·9	—	,,	100–50			
		20	—	−0·81	33·86	27·24	1·43	—	0·14	37·5	8·11	,,	250–100			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1263 *cont.*	66° 58·3′ S, 147° 21·4′ W	1934 14 i											
1264	68° 06·8′ S, 150° 49·1′ W	15 i	1000	4309*	W	12	W	3	om	1006·9	0·2	0·0	low W swell
1265	69° 07·7′ S, 153° 41′ W	15 i	2000	4336*	N	20	N	4	omd	997·4	−0·2	−0·3	heavy N swell
1266	69° 14·2′ S, 156° 30·4′ W	16 i	0912	4234*	NW	15	NW	2	c	996·3	0·6	0·3	low NW × W swell
1267	69° 49·4′ S, 159° 12·6′ W	16–18 i†	2107	3902*	N × E	6	N × E	2	om	993·2	0·0	0·0	no swell † Note 16–18 i 1934 indicates that St. 1267 was continued after midnight on the 16 i 1934, and since the International date line was crossed from east to west during this station, the 18th was the day following the 16th

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S‰	σt	Mg.—atom m.^{3}				O$_2$ c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N$_2$	Nitrite N$_2$	Si				From	To	
1263 *cont.*	29	30	—	−0·86	33·86	27·24	1·44	—	0·14	39·2	—	**N 70 V**	500–250			
		40	—	−0·90	33·87	27·26	1·44	—	0·13	39·2	8·01	,,	750–500			
		50	—	−0·96	33·87	27·26	1·58	—	0·13	40·9	—	,,	1000–750	—	**2129**	
		60	—	−1·30	33·95	27·33	1·60	—	0·19	38·7	7·77	**NHP**	50–0	**2130**	**2142**	
		80	—	−1·72	34·10	27·46	1·86	—	0·31	41·9	—	**CWS**	0			
		100	—	−1·70	34·13	27·48	1·81	—	0·28	43·3	7·29	,,	5			
		150	—	−0·59	34·36	27·64	2·01	—	0·00	71·5	5·99	,,	10			
		200	—	1·13	34·68	27·80	2·19	—	0·00	74·6	4·27	,,	20			
		300	—	1·35	34·74	27·84	2·11	—	0·00	77·3	4·03	,,	50			
		400	—	1·33	34·74	27·84	2·26	—	0·00	81·2	4·03	,,	100			
		590^1	588	1·15	34·74	27·85	2·26	—	—	85·9	4·03	**N 70 B**	165–0	**2246**	**2306**	KT
		790^1	—	1·10	34·72	27·83	2·17	—	—	94·0	4·12	**N 100 B**				
		990^1	—	0·89	34·71	27·85	2·20	—	—	101·4	4·27	**N 70 B**	500–250	**2246**	**2316**	DGP
		1490^1	1494	0·65	34·70	27·85	2·24	—	—	104·1	4·41	**N 100 B**				
		1990^2	1999	0·46	34·70	27·86	2·32	—	—	106·7	4·36					
		2490^2	—	0·29	34·70	27·87	2·32	—	—	107·5	4·47					
		2990^2	2987	0·12	34·69	27·86	2·32	—	—	112·1	4·63					
		3480^2	—	0·07	34·69	27·87	2·32	—	—	109·7	4·74					
		3980^2	3976	0·11	34·69	27·86	2·32	—	—	107·1	4·99					
1264	0	0	—	−0·78	33·93	27·30	—	—	—	—	—	**N 50 V**	100–0	1005		
												NHP	50–0	—	1018	
												N 70 B	142–0	1045	1105	KT
												N 100 B				
1265	0	0	—	−0·86	33·56	27·01	1·58	—	0·05	40·0	8·07	**N 50 V**	100–0	2012		
		5	—	−0·86	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·86	33·56	27·01	1·71	—	0·05	42·6	—	,,	100–50			
		20	—	−0·88	33·57	27·01	1·69	—	0·04	42·2	8·09	,,	250–100			
		30	—	−0·93	33·61	27·05	1·75	—	0·04	40·6	—	,,	500–250			
		40	—	−1·20	33·83	27·24	1·90	—	0·04	42·1	7·80	,,	750–500			
		50	—	−1·51	34·21	27·55	2·05	—	0·04	44·9	—	,,	1000–750	—	2137	
		60	—	−1·60	34·24	27·58	2·17	—	0·05	45·7	6·87	**NHP**	50–0	2129	2134	
		80	—	−1·53	34·29	27·61	2·19	—	0·06	46·5	—	**CWS**	0			
		100	—	−1·26	34·33	27·63	2·28	—	0·03	48·7	6·39	,,	5			
		150	—	−0·07	34·46	27·69	2·38	—	0·00	58·9	5·39	,,	10			
		200	—	1·11	34·63	27·76	2·55	—	0·00	69·5	4·40	,,	20			
		300	—	1·44	34·69	27·78	2·41	—	0·00	77·3	4·12	,,	50			
		400	—	1·41	34·71	27·81	2·57	—	0·00	82·4	4·07	,,	100			
		600^1	605	1·24	34·73	27·83	2·68	—	—	85·7	4·07	**N 70 B**	115–0	**2313**	**2333**	KT
		800^1	—	1·10	34·71	27·83	2·53	—	—	88·0	4·17	**N 100 B**				
		1000^1	—	0·99	34·70	27·83	2·53	—	—	92·9	4·24	**N 70 B**	390–180	**2313**	**2343**	DGP
		1500^1	1498	0·72	34·69	27·83	2·60	—	—	101·5	4·39	**N 100 B**				
		1960^2	1958	0·54	34·69	27·84	2·62	—	—	109·3	4·37					
		2450^2	—	0·37	34·69	27·85	2·66	—	—	117·0	4·49					
		2940^2	2935	0·26	34·69	27·86	2·72	—	—	119·0	4·50					
		3430^2	—	0·12	34·69	27·86	2·78	—	—	116·4	4·72					
		3920^2	3927	0·10	34·69	27·86	2·68	—	—	113·0	4·84					
1266	1	0	—	−1·10	33·60	27·05	—	—	—	—	—	**N 50 V**	100–0	0914		
												NHP	50–0	—	0929	
												N 70 B	180–0	0935	1000	KT
												N 100 B				
												N 100 H	0–5	0936	0956	
1267	1	0	—	−1·15	33·62	27·07	1·56	—	0·18	43·6	7·97	**N 50 V**	100–0	**2224**	—	+12 hours
		5	—	−1·14	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·15	33·62	27·07	1·54	—	0·18	44·1	—	,,	100–50			
		20	—	−1·18	33·62	27·07	1·58	—	0·17	46·2	7·98	,,	250–100			
		30	—	−1·42	33·95	27·34	1·75	—	0·12	49·7	—	,,	500–250			
		40	—	−1·50	34·23	27·57	1·96	—	0·11	55·9	7·14	,,	750–500			
		50	—	−1·50	34·29	27·61	2·15	—	0·09	52·4	—	,,	1000–750	—	**2337**	
		60	—	−1·42	34·33	27·64	2·20	—	0·08	53·9	6·40	**NHP**	50–0	**2342**	**2346**	
		80	—	−1·26	34·36	27·66	2·13	—	0·08	54·8	—	**CWS**	0			
		100	—	−0·99	34·41	27·69	2·36	—	0·06	54·1	5·83	,,	5			
		150	—	−0·22	34·50	27·73	2·36	—	0·00	60·8	5·26	,,	10			
		200	—	0·68	34·60	27·76	2·57	—	0·00	67·1	4·63	,,	20			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1267 *cont.*	69° 49·4′ S, 159° 12·6′ W	1934 16–18 i											
1268	68° 34·7′ S, 161° 20′ W	18 i	1010	4159*	NE × N	12	NE × N	2	om	983·8	0·3	0·1	no swell
1269	67° 33·8′ S, 162° 53·7′ W	18 i	2000	3568*	NE	12	NE	3	ofe	985·5	0·0	0·0	mod. NE swell
1270	66° 29·5′ S, 164° 30·2′ W	19 i	0902	4003*	NE × E	10	NE × E	3	fe	981·3	1·1	1·1	mod. NE swell
1271	65° 05·3′ S, 166° 08·4′ W	19 i	2000	3004*	ESE	15	ESE	4	ome	974·0	1·1	0·5	heavy conf. ESE and NW × W swells

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Mg.—atom m.³				Gear	Depth (metres)	TIME		
								Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre			From	To	
1267 *cont.*	1	300	—	1·41	34·69	27·78	2·41	—	0·00	70·5	4·16	,,	50			
		400	—	1·42	34·71	27·81	2·41	—	0·00	77·0	4·12	,,	100			
		600^1	595	1·25	34·74	27·84	2·57	—	—	83·6	4·05	**N 70 B**	155–0	**0036**	**0056**	KT. N 100 B bucket leaking
		800^1	—	1·11	34·72	27·83	2·57	—	—	88·1	4·15	**N 100 B**				
		1000^1	1006	0·97	34·71	27·84	2·66	—	—	93·9	4·25	**N 70 B**	480–210	**0036**	**0106**	DGP. N 100 B bucket leaking
		1490^2	1497	0·70	34·70	27·85	2·66	—	—	99·8	4·32	**N 100 B**				
		1980^2	—	0·51	34·69	27·84	2·66	—	—	106·1	4·41	**N 100 H**	0–5	**0036**	**0106**	
		2480^2	2479	0·31	34·69	27·85	2·70	—	—	111·9	4·49					
		2970^2	—	0·19	34·69	27·86	2·70	—	—	115·0	4·58					
		3470^2	3470	0·10	34·69	27·86	2·62	—	—	104·2	4·85					
1268	2	0	—	−0·94	33·60	27·04	—	—	—	—	—	**N 50 V**	100–0	1012	—	−12 hours
												NHP	50–0	—	1027	
												N 70 B	182–0	1035	1055	KT
												N 100 B				
												N 100 H	0–5	1036	1057	
1269	2	0	—	−0·40	33·98	27·33	1·16	—	0·13	37·6	7·81	**N 50 V**	100–0	2007		
		5	—	−0·40	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·40	33·98	27·33	1·20	—	0·13	37·8	—	,,	100–50			
		20	—	−0·40	33·98	27·33	1·12	—	0·14	40·7	7·81	,,	250–100			
		30	—	−0·40	33·98	27·33	1·10	—	0·13	40·9	—	,,	500–250			
		40	—	−0·53	34·02	27·37	1·24	—	0·14	41·9	7·75	,,	750–500			
		50	—	−0·60	34·05	27·39	1·33	—	0·14	40·0	—	,,	1000–750	—	**2123**	
		60	—	−1·29	34·22	27·54	1·81	—	0·13	54·5	7·01	**NHP**	50–0	**2118**	**2122**	
		80	—	−1·55	34·33	27·64	2·22	—	0·13	57·9	—	**CWS**	0			
		100	—	−1·18	34·41	27·70	2·22	—	0·14	56·9	5·84	,,	5			
		150	—	0·99	34·68	27·81	2·41	—	0·06	72·1	4·27	,,	10			
		200	—	1·41	34·75	27·84	2·41	—	0·00	75·7	4·07	,,	20			
		300	—	1·41	34·75	27·84	2·40	—	0·00	80·9	4·10	,,	50			
		400	—	1·33	34·76	27·85	2·26	—	0·00	85·5	4·10	,,	100			
		600^1	596	1·19	34·76	27·86	2·45	—	—	90·4	4·11	**N 70 B**	142–0	**2223**	**2243**	KT
		800^1	—	1·06	34·75	27·87	2·45	—	—	98·4	4·18	**N 100 B**				
		1000^1	1006	0·89	34·73	27·86	2·66	—	—	104·0	4·30	**N 70 B**	430–190	**2223**	**2254**	DGP
		1490^2	1499	0·66	34·71	27·86	2·66	—	—	107·8	4·42					
		1980^2	—	0·45	34·70	27·87	2·66	—	—	113·3	4·55					
		2480^2	2486	0·28	34·70	27·87	2·66	—	—	123·1	4·75					
		2980^2	—	0·15	34·70	27·88	2·66	—	—	106·6	4·82					
		3470^2	3451	0·09	34·69	27·87	2·62	—	—	101·6	4·84					
1270	3	0	—	0·00	33·98	27·31	—	—	—	—	—	**N 50 V**	100–0	0908		
												NHP	50–0	—	0923	
												N 70 B	133–0	0931	0951	KT
												N 100 B				
1271	4	0	—	0·08	34·02	27·34	2·13	—	0·19	53·0	7·60	**N 50 V**	100–0	2009		
		5	—	0·07	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·07	34·02	27·34	2·13	—	0·17	52·2	—	,,	100–50			
		20	—	0·05	34·03	27·35	2·13	—	0·17	52·4	7·61	,,	250–100			
		30	—	0·03	34·03	27·35	2·11	—	0·17	53·7	—	,,	500–250			
		40	—	0·03	34·03	27·35	2·13	—	0·18	53·8	7·60	,,	750–500			
		50	—	−0·48	34·14	27·46	2·15	—	0·14	55·3	—	,,	1000–750	—	**2137**	
		60	—	−1·51	34·23	27·57	2·24	—	0·07	58·9	7·08	**NHP**	50–0	**2138**	**2144**	
		80	—	−1·59	34·27	27·60	2·36	—	0·07	57·7	—	**CWS**	0			
		100	—	−1·05	34·40	27·69	2·45	—	0·11	65·2	5·82	,,	5			
		150	—	1·21	34·71	27·83	2·78	—	0·04	74·0	4·21	,,	10			
		200	—	1·38	34·72	27·82	2·70	—	0·00	75·8	4·12	,,	20			
		300	—	1·40	34·76	27·84	2·64	—	0·00	81·1	4·16	,,	50			
		400	—	1·33	34·76	27·85	2·70	—	0·00	79·5	4·25	,,	100			
		590^1	580	1·14	34·74	27·85	2·72	—	—	83·8	4·17	**N 70 B**	122–0	**2223**	**2243**	KT
		790^1	—	1·02	34·72	27·84	2·74	—	—	89·9	4·25	**N 100 B**				
		990^1	998	0·88	34·74	27·87	2·74	—	—	91·7	4·40	**N 70 B**	390–200	**2223**	**2253**	DGP
		1490^2	—	0·59	34·73	27·88	2·74	—	—	96·4	4·39	**N 100 B**				
		1980^2	1976	0·38	34·72	27·88	2·89	—	—	103·2	4·59					
		2480^2	—	0·32	34·71	27·88	2·76	—	—	107·1	4·68					
		2880^2	2885	0·18	34·71	27·89	2·91	—	—	115·7	4·75					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1272	63° 41·3′ S, 167° 36·3′ W	1934 20 i	0900	2663*	SE × S	15	SE × S	4	oms	964·5	0·6	0·5	heavy conf. NW and mod. conf. SE × S swells
1273	62° 08·1′ S, 168° 59·5′ W	20 i	2000	3125*	SSW	12	SSW	4	os	963·4	1·1	0·9	heavy conf. NW and ESE swells
1274	60° 41·4′ S, 169° 17·8′ W	21 i	0900	3848*	W	21	W	4	ogr	976·2	1·7	1·4	heavy W swell
1275	59° 29·2′ S, 170° 01·8′ W	21 i	1950	3996*	W × S	37	W × S	6	oqprg	988·8	3·4	2·4	heavy W × S swell
1276	56° 36·3′ S, 171° 38·7′ W	22 i	1800	4980*	E	30	E	6	oqr	986·1	5·6	5·6	heavy E swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³				O₂ c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N₂	Nitrite N₂	Si				From	To	
1272	4	0	—	0·60	33·77	27·10	—	—	—	—	—	**N 50 V**	100–0	0909		
												NHP	50–0	—	0934	
												N 70 B	120–0	0940	1000	KT
												N 100 B				
1273	5	0	—	2·10	33·66	26·91	1·12	—	0·24	<3·3	7·61	**N 50 V**	100–0	2010		
		5	—	2·10	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	2·09	33·66	26·91	1·06	—	0·24	<3·3	—	,,	100–50			
		20	—	1·85	33·67	26·94	1·03	—	0·24	<3·3	7·76	,,	250–100			
		30	—	1·82	33·68	26·95	1·08	—	0·23	<3·3	—	,,	500–250			
		40	—	0·41	33·84	27·17	2·11	—	0·23	15·6	7·65	,,	750–500			
		50	—	−0·02	33·97	27·30	2·38	—	0·20	26·6	—	,,	1000–750	—	**2130**	
		60	—	−0·13	33·99	27·33	2·45	—	0·19	29·5	7·39	**NHP**	50–0	**2135**	**2150**	
		80	—	−0·21	34·04	27·36	2·34	—	0·20	35·9	—	**CWS**	0			
		100	—	−0·13	34·06	27·38	2·45	—	0·22	36·2	7·07	,,	5			
		150	—	0·50	34·22	27·46	2·59	—	0·04	45·6	5·95	,,	10			
		200	—	1·15	34·34	27·53	2·59	—	0·00	51·6	5·18	,,	20			
		300	—	1·84	34·51	27·61	2·68	—	0·00	58·3	4·33	,,	50			
		400	—	2·22	34·60	27·65	2·68	—	0·00	61·8	3·88	,,	100			
		600[1]	593	2·14	34·67	27·72	2·70	—	—	70·3	3·88	**N 70 B**	131–0	**2314**	**2334**	KT
		790[1]	—	2·02	34·73	27·78	2·70	—	—	71·8	3·96	**N 100 B**				
		990[1]	996	1·89	34·76	27·81	2·45	—	—	77·3	4·06	**N 70 B**	420–210	**2314**	**2345**	DGP
		1480[2]	1467	1·55	34·76	27·83	2·47	—	—	84·0	4·25	**N 100 B**				
		1970[2]	—	1·17	34·76	27·86	2·51	—	—	91·3	4·33					
		2460[2]	—	0·82	34·74	27·87	2·59	—	—	97·6	4·42					
		2950[2]	2964	0·76	34·73	27·87	2·64	—	—	105·7	4·48					
1274	5	0	—	3·20	33·93	27·03	—	—	—	—	—	**N 50 V**	100–0	0908		
												NHP	50–0	—	0919	
												N 70 B	180–0	0925	0945	KT
												N 100 B				
1275	6	0	—	3·84	33·94	26·98	1·69	—	0·23	<3·3	7·09	**CWS**	0			
		5	—	3·84	—	—	—	—	—	—	—	,,	5			
		10	—	3·84	33·95	26·99	1·71	—	0·23	<3·3	—	,,	10			
		20	—	3·83	33·95	26·99	1·60	—	0·21	<3·3	7·11	,,	20			
		30	—	3·83	33·95	26·99	1·63	—	0·21	<3·3	—	,,	50			
		40	—	3·83	33·95	26·99	1·71	—	0·20	<3·3	7·10	,,	100			
		50	—	3·83	33·95	26·99	1·62	—	0·21	<3·3						
		60	—	3·83	33·95	26·99	1·65	—	0·22	<3·3	7·12					
		80	—	2·64	33·97	27·12	2·01	—	0·19	13·9						
		100	—	2·53	33·99	27·15	2·11	—	0·22	17·0	7·07					
		150	—	2·02	34·02	27·21	2·13	—	0·30	16·4	6·93					
		200	—	1·82	34·03	27·24	2·26	—	0·00	21·8	6·82					
		300	—	2·14	34·13	27·28	2·41	—	0·00	28·2	6·02					
		400	—	2·68	34·30	27·38	2·62	—	0·00	41·4	4·84					
1276	7	0	—	5·83	34·02	26·82	1·56	—	0·18	<3·3	6·76	**N 50 V**	100–0	1800		
		5	—	5·83	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	5·83	34·02	26·82	1·62	—	0·19	<3·3	—	,,	100–50			
		20	—	5·83	34·02	26·82	1·56	—	0·18	<3·3	6·78	,,	250–100			
		30	—	5·84	34·02	26·82	1·60	—	0·18	<3·3	—	,,	500–250			
		40	—	5·84	34·04	26·83	1·62	—	0·18	<3·3	6·77	,,	750–500			
		50	—	5·84	34·04	26·83	1·60	—	0·18	<3·3	—	,,	1000–750	—	1940	
		60	—	5·51	34·04	26·87	1·54	—	0·19	<3·3	6·71	**NHP**	50–0	1940	1945	
		80	—	5·11	34·06	26·94	1·65	—	0·27	<3·3	—	**CWS**	0			
		100	—	5·05	34·11	26·99	1·73	—	0·24	<3·3	6·55	,,	5			
		150	—	4·85	34·13	27·02	1·79	—	0·12	<3·3	6·42	,,	10			
		195	—	4·41	34·11	27·06	1·71	—	0·00	8·7	6·50	,,	20			
		295	—	4·02	34·13	27·11	2·01	—	0·00	14·8	6·37	,,	50			
		390	—	3·98	34·20	27·17	2·32	—	0·00	24·5	5·43	,,	100			
		590[1]	585	3·39	34·28	27·30	2·70	—	—	30·1	4·70	**N 100 B**	140–0	**2043**	**2103**	Depth estimated
		790[1]	768	2·80	34·39	27·44	2·89	—	—	40·4	4·19	**N 70 B**	400–200	**2043**	**2113**	Depths of nets estimated
		980[1]	—	2·51	34·46	27·52	2·89	—	—	55·5	3·87	**N 100 B**				
		1470[1]	1479	2·24	34·70	27·74	2·64	—	—	60·6	3·87					
		1960[2]	2009?	2·01	34·75	27·80	2·64	—	—	64·7	4·02					
		2440[2]	—	1·62	34·76	27·83	2·66	—	—	74·6	4·24					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1276 *cont.*	56° 36·3′ S, 171° 38·7′ W	1934 22 i											
1277	53° 58′ S, 172° 10′ W	23 i	2000	5285*	W × N	25	W × N	6	bcqr	984·6	7·2	5·0	heavy W × N swell
1278	51° 43·1′ S, 173° 17·6′ W	24 i	2000	5389*	W × S	25	W × N	5	or	976·5	9·4	9·1	heavy conf. NW swell
1279	49° 26·8′ S, 174° 43·5′ W	25 i	2000	5313*	NW	30	NW	5	cq	988·9	11·7	11·1	heavy NW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS					Mg.—atom m.³					BIOLOGICAL OBSERVATIONS		TIME		Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
1276 *cont.*	7	2930^2	—	1·29	34·76	27·85	2·66	—	—	76·8	4·29					
		3420^2	3423	1·01	34·75	27·87	2·70	—	—	90·2	4·49					
1277	8	0	—	8·45	34·20	26·60	0·95	—	0·15	<3·3	6·30	**N 50 V**	100–0	**2008**		
		5	—	8·45	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	8·45	34·20	26·60	1·03	—	0·15	<3·3	—	,,	100–50			
		20	—	8·45	34·20	26·60	0·93	—	0·15	<3·3	6·33	,,	250–100			
		30	—	8·45	34·20	26·60	0·99	—	0·15	<3·3	—	,,	500–250			
		40	—	8·45	34·20	26·60	0·99	—	0·15	<3·3	6·32	,,	750–500			
		50	—	8·45	34·20	26·60	0·97	—	0·16	<3·3	—	,,	1000–750	—	**2133**	
		60	—	8·45	34·20	26·60	1·05	—	0·16	<3·3	6·31	**NHP**	50–0	**2200**	**2205**	
		80	—	8·13	34·19	26·65	1·14	—	0·20	<3·3	—	**CWS**	0			
		100	—	6·78	34·15	26·81	1·33	—	0·29	<3·3	6·40	,,	5			
		150	—	6·59	34·27	26·92	1·44	—	0·05	<3·3	6·14	,,	10			
		200	—	6·55	34·28	26·94	1·48	—	0·00	<3·3	6·04	,,	20			
		300	—	5·98	34·27	27·00	1·60	—	0·00	10·4	6·03	,,	50			
		400	—	5·79	34·29	27·03	1·71	—	0·00	11·7	5·62	,,	100			
		590^1	601	4·70	34·31	27·18	2·26	—	—	19·0	4·96	**N 100 B**	170–0	**2303**	**2324**	KT
		790^1	784	3·73	34·32	27·30	2·59	—	—	31·8	4·51	**N 70 B**	} 450–250	**2303**	**2336**	Depths of nets estimated
		990^1	—	3·14	34·40	27·41	2·76	—	—	45·4	4·12	**N 100 B**				
		1480^1	1485	2·44	34·60	27·63	2·91	—	—	59·6	3·77					
		1990^2	1996	2·23	34·72	27·75	2·79	—	—	64·6	3·82					
		2490^2	—	1·94	34·76	27·80	2·57	—	—	71·5	4·03					
		2980^2	—	1·53	34·76	27·83	2·64	—	—	76·0	4·23					
		3480^2	3474	1·21	34·75	27·86	2·72	—	—	87·3	4·35					
1278	9	0	—	9·18	34·25	26·52	0·82	—	0·15	<3·3	6·20	**N 50 V**	100–0	**2010**		
		10	—	9·18	34·25	26·52	0·84	—	0·15	<3·3	—	**N 70 V**	50–0			
		20	—	9·18	34·25	26·52	0·89	—	0·15	<3·3	6·21	,,	100–50			
		30	—	9·18	34·26	26·53	0·91	—	0·14	<3·3	—	,,	250–100			
		40	—	9·18	34·26	26·53	0·93	—	0·14	<3·3	6·22	,,	500–250			
		50	—	9·18	34·26	26·53	0·93	—	0·14	<3·3	—	,,	750–500			
		60	—	9·17	34·26	26·53	0·93	—	0·14	<3·3	6·21	,,	1000–750			
		80	—	8·05	34·31	26·74	1·08	—	0·18	<3·3	—	**NHP**	50–0	—	**2143**	
		100	—	7·95	34·33	26·77	1·22	—	0·31	<3·3	6·14	**N 100 B**	119–0	**2315**	**2335**	KT
		150	—	6·85	34·29	26·90	1·24	—	0·21	<3·3	6·21	,,	380–200	**2315**	**2345**	Depths of nets estimated
		195	—	7·06	34·35	26·93	1·27	—	0·00	<3·3	6·00					
		295	—	6·82	34·36	26·96	1·43	—	0·00	7·3	5·85					
		390	—	6·57	34·34	26·98	1·58	—	0·00	10·7	5·75					
		590^1	576	5·26	34·22	27·04	1·88	—	—	12·3	5·62					
		780^1	—	4·43	34·26	27·17	2·57	—	—	22·1	4·85					
		980^1	—	3·69	34·33	27·30	2·68	—	—	37·2	4·40					
		1460^1	1482	2·68	34·52	27·55	2·95	—	—	53·8	3·82					
		1940^2	1939	2·34	34·66	27·69	2·91	—	—	57·9	3·72					
		2430^2	—	2·08	34·68	27·73	2·78	—	—	67·6	3·89					
		2920^2	—	1·74	34·75	27·82	2·55	—	—	72·3	4·08					
		3400^2	3407	1·38	34·75	27·85	2·78	—	—	86·8	4·22					
1279	10	0	—	10·56	34·14	26·21	0·89	—	0·12	<3·3	6·06	**N 50 V**	100–0	**2007**		
		10	—	10·56	34·14	26·21	0·76	—	0·12	<3·3	—	**N 70 V**	50–0			
		20	—	10·56	34·14	26·21	0·91	—	0·11	<3·3	6·07	,,	100–50			
		30	—	10·56	34·14	26·21	0·84	—	0·11	<3·3	—	,,	250–100			
		40	—	10·56	34·14	26·21	0·87	—	0·11	<3·3	6·06	,,	500–250			
		50	—	10·53	34·14	26·22	0·91	—	0·12	<3·3	—	,,	750–500			
		60	—	9·76	34·14	26·35	0·99	—	0·13	<3·3	6·18	,,	1000–750	—	**2150**	
		80	—	6·87	34·15	26·80	1·60	—	0·25	<3·3	—	**NHP**	50–0	**2152**	**2158**	
		100	—	6·63	34·16	26·83	1·63	—	0·30	<3·3	6·37	**N 100 B**	164–0	**2248**	**2308**	KT
		150	—	6·85	34·31	26·92	1·44	—	0·09	<3·3	6·08	**N 70 B**	} 450–250	**2248**	**2319**	Depths of nets estimated
		200	—	6·16	34·22	26·93	1·46	—	0·00	8·7	6·17	**N 100 B**				
		300	—	5·53	34·19	27·00	1·50	—	0·00	11·1	6·14					
		395	—	5·40	34·23	27·04	1·86	—	0·00	13·7	5·63					
		590^1	588	4·56	34·31	27·20	2·41	—	—	24·0	4·78					
		790^1	—	3·49	34·33	27·32	2·83	—	—	33·7	4·52					
		990^1	—	3·22	34·41	27·42	2·93	—	—	49·9	3·99					
		1490^1	1492	2·46	34·59	27·63	3·08	—	—	56·1	3·75					
		1970^2	1957	2·21	34·70	27·74	2·93	—	—	67·0	3·78					
		2460^2	—	1·94	34·76	27·80	2·59	—	—	74·1	4·05					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1279 *cont.*	49° 26·8′ S, 174° 43·5′ W	1934 25 i											
1280	47° 16·5′ S, 175° 50·6′ W	26 i	2000	5130*	WNW	25	WNW	5	bcq	1008·5	12·5	11·9	heavy conf. WNW and WSW swells
1281	40° 43·2′ S, 179° 48·6′ W	28 i	2000	2579*	ENE	10	ENE	3	o	1020·6	14·8	13·0	mod. conf. E swell
1282	66° 05·9′ S, 170° 32·5′ W	20 ii	2200	3058*	W	13	WNW	3	c	984·6	0·2	−0·1	heavy NW × W swell
1283	72° 01·2′ S, 171° 25·7′ W	23 ii	1320	3950*	SSE	2	SSE	2	c	975·6	−2·0	−2·8	low SSE swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS					Mg.—atom m.^{3}					BIOLOGICAL OBSERVATIONS		TIME		Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N$_2$	Nitrite N$_2$	Si	O$_2$ c.c. litre	Gear	Depth (metres)	From	To	
1279 *cont.*	10	2960^2	—	1·56	34·75	27·83	2·59	—	—	78·8	4·27					
		3450^2	3462	1·22	34·75	27·86	2·83	—	—	92·6	4·34					
1280	11	0	—	12·72	34·78	26·30	0·27	—	0·11	<3·3	5·81	**N 50 V**	100–0	**2006**		
		10	—	12·72	34·78	26·30	0·27	—	0·11	<3·3	—	**N 70 V**	50–0			
		20	—	12·72	34·78	26·30	0·27	—	0·13	<3·3	5·80	,,	100–50			
		30	—	12·72	34·78	26·30	0·29	—	0·12	<3·3	—	,,	250–100			
		40	—	12·72	34·78	26·30	0·21	—	0·12	<3·3	5·79	,,	500–250			
		50	—	12·71	34·78	26·30	0·36	—	0·12	<3·3	—	,,	750–500			
		60	—	12·69	34·78	26·30	0·34	—	0·12	<3·3	5·78	,,	1000–750	—	**2155**	
		80	—	10·67	34·83	26·72	0·59	—	0·13	<3·3	—	**NHP**	50–0	**2155**	**2200**	
		95	—	10·49	34·84	26·76	0·63	—	0·00	<3·3	5·64	**N 70 B**	170–0	**2328**	**2348**	KT
		145	—	9·96	34·77	26·80	0·59	—	0·00	<3·3	5·69	**N 100 B**				
		190	—	9·58	34·76	26·85	0·55	—	0·00	<3·3	5·67	**N 70 B**	450–250	**2328**	**2359**	Depths of nets estimated
		285	—	9·18	34·75	26·92	0·97	—	0·00	7·6	4·96	**N 100 B**				
		380	—	8·41	34·66	26·96	0·95	—	0·00	7·2	5·26					
		570^1	572	7·69	34·56	26·99	1·41	—	—	10·4	4·95					
		760^1	—	6·78	34·45	27·03	1·60	—	—	14·8	4·69					
		950^1	—	5·80	34·45	27·16	2·13	—	—	22·6	4·24					
		1430^1	1430	3·19	34·47	27·47	2·62	—	—	46·4	3·98					
		1980^2	1977	2·44	34·66	27·68	2·76	—	—	57·7	3·60					
		2470^2	—	2·21	34·75	27·78	2·59	—	—	65·4	3·79					
		2960^2	—	1·82	34·78	27·83	2·59	—	—	79·2	3·98					
		3460^2	3456	1·45	34·77	27·85	2·28	—	—	88·2	4·24					
1281	13	0	—	15·73	34·84	25·71	0·19	—	0·00	0·0	5·55	**N 50 V**	100–0	**2008**		
		10	—	15·78	34·84	25·70	0·21	—	0·00	<3·3	—	**N 70 V**	50–0			
		20	—	15·73	34·84	25·71	0·19	—	0·00	<3·3	5·56	,,	100–50			
		30	—	15·23	34·84	25·82	0·21	—	0·00	<3 3	—	,,	250–100			
		40	—	14·73	34·84	25·92	0·21	—	0·00	<3·3	5·72	,,	500–250			
		50	—	13·98	34·84	26·09	0·30	—	0·10	<3·3	—	,,	750–500			
		60	—	13·78	34·84	26·13	0·34	—	0·23	<3·3	5·52	,,	1000–750	—	**2127**	
		80	—	13·48	34·84	26·19	0·48	—	0·47	<3·3	—	**NHP**	50–0	**2127**	**2132**	
		100	—	12·38	34·89	26·45	0·51	—	0·00	<3·3	5·37	**N 70 B**	114–0	**2212**	**2232**	KT
		150	—	11·25	34·91	26·68	0·80	—	0·00	<3·3	5·53	**N 100 B**				
		200	—	11·36	34·93	26·67	0·80	—	0·00	<3·3	5·54	**N 70 B**	400–200	**2212**	**2242**	Depths of nets estimated
		300	—	10·92	34·89	26·72	0·82	—	0·00	<3·3	5·25	**N 100 B**				
		400	—	9·69	34·78	26·85	1·12	—	0·00	<3·3	4·59					
		600^1	600	7·54	34·59	27·04	1·69	—	—	12·5	4·41					
		790^1	790	4·90	34·50	27·31	2·43	—	—	38·8	3·98					
		990^2	1000	4·03	34·51	27·41	2·74	—	—	49·3	3·63					
		1490^2	—	2·78	34·60	27·60	3·04	—	—	70·7	3·46					
		1990^2	—	2·14	34·67	27·72	3·16	—	—	84·2	3·29					
		2480^2	2475	1·67	34·75	27·82	2·79	—	—	88·1	3·86					
1282	6	0	—	−0·10	33·88	27·24	—	—	—	—	—	**N 50 V**	100–0	**2204**		
												NHP	50–0	—	**2226**	
												N 70 B	124–0	**2234**	**2254**	KT
												N 100 B				
1283	8	0	—	−1·48	33·43	26·93	1·56	—	0·14	37·9	7·82	**N 50 V**	100–0	1330		
		5	—	−1·48	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·50	33·43	26·93	1·50	—	0·14	38·1	—	,,	100–50			
		20	—	−1·55	33·44	26·93	1·60	—	0·14	37·6	7·82	,,	250–100			
		30	—	−1·45	34·13	27·48	2·01	—	0·06	38·8	—	,,	500–250			
		40	—	−1·52	34·23	27·57	2·09	—	0·06	41·0	6·70	,,	750–500			
		50	—	−1·57	34·25	27·58	2·09	—	0·04	44·3	—	,,	1000–750	—	1500	
		60	—	−1·58	34·27	27·60	2·09	—	0·04	45·5	6·56	**NHP**	50–0	1500	1508	
		80	—	−1·58	34·27	27·60	2·17	—	0·06	47·3	—	**CWS**	0			
		100	—	−1·54	34·29	27·61	2·30	—	0·08	48·8	6·39	,,	5			
		150	—	−0·73	34·33	27·61	2·26	—	0·04	50·6	5·85	,,	10			
		200	—	0·01	(34·37)	(27·62)	2·28	—	0·00	54·2	5·37	,,	20			
		300	—	1·33	34·68	27·79	2·38	—	0·00	69·6	4·33	,,	50			
		400	—	1·54	34·75	27·83	2·26	—	0·00	74·0	4·10	,,	100			
		600^1	588	1·42	34·76	27·84	2·43	—	—	79·6	3·96	**N 70 B**	141–0	1621	1651	KT
		790^1	—	1·25	34·76	27·85	2·45	—	—	85·4	4·01	**N 100 B**				
		990^1	999	1·14	34·75	27·86	2·62	—	—	91·8	4·14	**N 70 B**	350–160	1621	1654	DGP
		1500^2	1504	0·83	34·73	27·86	2·59	—	—	95·8	4·19	**N 100 B**				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1283 *cont.*	72° 01·2′ S, 171° 25·7′ W	1934 23 ii											
1284	69° 48·1′ S, 167° 20·7′ W	24 ii	0900	4188*	E	18	E	4	c	970·9	−0·6	−0·6	mod. conf. E swell
1285	68° 45′ S, 164° 35·8′ W	24 ii†	2000	3444*	SE	25	SE	4	o	968·4	−0·6	−0·6	mod. swell † The international date line was crossed from west to east between Sts. 1285 and 1286. In consequence note that times of nets, etc. at St. 1285 were −12 hours and at St. 1286 were +12 hours both relative to GMT
1286	67° 42·2′ S, 162° 08′ W	24 ii	0900	3958*	SSE	20	SSE	5	o	982·4	0·0	0·0	heavy SSE swell
1287	68° 05·3′ S, 158° 56·6′ W	24–25 ii	2000 0000	4353* —	S SSW	20 22	S SSW	4 4	o o	991·2 992·6	−0·8 −1·2	−0·8 −1·6	heavy S swell mod. SSW swell
1288	68° 27·8′ S, 156° 16′ W	25 ii	0906	4128*	S × W	14	S × W	3	o	991·0	−2·3	−2·3	mod. SSW swell

ation	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
283	8	1990[2]	—	0·61	34·70	27·86	2·55	—	—	98·2	4·24	**N 100 H**	0–5	1639	1654	
ont.		2490[2]	2489	0·43	34·70	27·87	2·55	—	—	106·0	4·45					
		2990[2]	—	0·30	34·70	27·87	2·57	—	—	106·2	4·30					
		3490[2]	3487	0·19	34·70	27·88	2·57	—	—	111·5	4·62					
284	9	0	—	−0·15	33·88	27·24	—	—	—	—	—	**N 50 V**	100–0	0911		
												NHP	50–0	—	0925	
												N 70 B	119–0	0934	0954	KT
												N 100 B				
285	10	0	—	−0·29	33·84	27·20	1·52	—	0·21	40·7	7·67	**N 50 V**	100–0	**2008**		
		5	—	−0·29	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·29	33·84	27·20	1·52	—	0·19	41·6	—	,,	100–50			
		20	—	−0·29	33·84	27·20	1·52	—	0·20	42·1	7·65	,,	250–100			
		30	—	−0·29	33·84	27·20	1·56	—	0·20	44·9	—	,,	500–250			
		40	—	−0·29	33·86	27·21	1·62	—	0·21	44·5	7·62	,,	750–500			
		50	—	−1·22	34·22	27·54	2·32	—	0·10	51·1	—	,,	1000–750	—	**2159**	
		60	—	−1·33	34·34	27·65	2·32	—	0·06	54·8	6·20	**NHP**	50–0	**2155**	**2203**	
		80	—	−1·03	34·39	27·69	2·32	—	0·11	58·6	—	**CWS**	0			
		100	—	−0·81	34·46	27·73	2·45	—	0·14	61·5	5·66	,,	5			
		150	—	0·09	34·56	27·77	2·51	—	0·00	66·1	5·00	,,	10			
		200	—	0·80	34·67	27·81	2·53	—	0·00	70·3	4·54	,,	20			
		300	—	1·38	34·76	27·85	2·49	—	0·00	78·1	4·17	,,	50			
		400	—	1·35	34·76	27·85	2·59	—	0·00	85·6	4·18	,,	100			
		600[1]	601	1·21	34·76	27·86	2·59	—	—	91·6	4·15	**N 100 B**	170–0	**2250**	**2312**	Depth estimated
		800[1]	—	1·03	34·75	27·87	2·66	—	—	97·3	4·20	**N 70 B**	510–230	**2250**	**2322**	DGP
		1000[1]	1001	0·93	34·74	27·87	2·45	—	—	102·9	4·22	**N 100 B**	510–0	**2250**	**2332**	
		1500[2]	1517	0·69	34·73	27·87	2·59	—	—	104·0	4·40	**N 100 H**	0–5	**2250**	**2324**	
		2000[2]	—	0·44	34·72	27·88	2·70	—	—	100·3	4·61					
		2500[2]	—	0·28	34·71	27·88	2·79	—	—	106·6	4·57					
		3000[2]	2998	0·12	34·71	27·89	2·70	—	—	105·6	4·75					
1286	10	0	—	−0·15	33·88	27·24	—	—	—	—	—	**N 50 V**	100–0	0927		+12 hours
												NHP	50–0	—	0942	
												N 100 B	170–0	1001	1021	KT
												N 70 B	520–180	1001	1031	DGP
												N 100 B				
												N 100 H	0–5	1001	1031	
1287	11	0	—	−0·11	33·96	27·30	1·54	—	0·16	30·9	7·61	**N 50 V**	100–0	**2010**		
		5	—	−0·11	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·11	33·97	27·31	1·54	—	0·16	28·5	—	,,	100–50			
		20	—	−0·11	33·97	27·31	1·56	—	0·14	28·9	7·61	,,	250–100			
		30	—	−0·11	33·97	27·31	1·56	—	0·16	30·1	—	,,	500–250			
		40	—	−0·11	33·97	27·31	1·56	—	0·15	29·0	7·61	,,	750–500			
		50	—	−0·20	33·99	27·33	1·54	—	0·14	32·6	—	,,	1000–750			
		60	—	−1·20	34·29	27·60	2·34	—	0·11	47·4	6·62	**NHP**	50–0	—	**2152**	
		80	—	−1·26	34·38	27·68	2·38	—	0·10	50·3	—	**CWS**	0			
		100	—	−0·97	34·43	27·71	2·49	—	0·11	52·5	5·94	,,	5			
		150	—	0·29	34·54	27·74	2·49	—	0·00	61·3	5·39	,,	10			
		200	—	1·12	34·67	27·79	2·70	—	0·00	74·1	4·35	,,	20			
		295	—	1·44	34·75	27·84	2·59	—	0·00	79·2	4·18	,,	50			
		395	—	1·41	34·76	27·84	2·62	—	0·00	84·4	4·11	,,	100			
		590[1]	584	1·23	34·76	27·86	2·68	—	—	84·5	4·05	**N 70 B**	390–200	**2359**	**0029**	DGP
		790[1]	—	1·08	34·76	27·87	2·68	—	—	89·7	4·17	**N 100 B**				
		980[1]	988	0·96	34·75	27·87	2·74	—	—	93·6	4·23	**N 100 H**	0–5	**2359**	**0029**	
		1470[1]	—	0·71	34·74	27·88	2·79	—	—	98·7	4·35	**N 100 B**	154–0	**0043**	**0103**	KT
		1990[2]	1996	0·50	34·73	27·88	2·72	—	—	100·3	4·60					
		2490[2]	—	0·31	34·72	27·88	2·79	—	—	109·2	4·14					
		2990[2]	2992	0·21	34·71	27·89	2·72	—	—	111·3	4·29					
		3490[2]	—	0·11	34·71	27·89	2·78	—	—	100·2	4·47					
		3990[2]	3975	0·11	34·71	27·89	2·81	—	—	116·3	4·52					
1288	11	0	—	−0·30	34·05	27·38	—	—	—	—	—	**N 50 V**	100–0	0908		+11 hours
												NHP	50–0	—	0921	
												N 70 B	135–0	0929	0949	KT
												N 100 B				
												N 100 H	0–5	0930	0952	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1289	69° 08′ S, 152° 42·4′ W	1934 25–26 ii	2000	4376*	SSW	20	S	3	o	984·9	−3·0	−3·0	mod. S swell
			0000	—	S	16	S	4	o	985·6	−3·3	−3·3	mod. conf. S swell
1290	69° 45·8′ S, 149° 42·9′ W	26 ii	0900	4382*	SSW	18	SSW	4	ogs	983·0	−4·2	−5·6	mod. SSW swell
1291	70° 28·2′ S, 145° 55·2′ W	26 ii	2000	4353*	SSW	30	SSW	6	o	984·0	−2·2	−2·2	heavy SSW swell
1292	71° 25·1′ S, 143° 34·6′ W	27 ii	0900	4300*	SW	16	SW	3	c	995·8	−3·2	−4·4	low SSW swell
1293	70° 08·4′ S, 140° 26′ W	27–28 ii	2000	4411*	WSW	14	SW × W	2	o	996·8	−2·2	−3·3	low SW swell
			0000	—	W × S	12	W × S	3	o	996·0	−1·7	−2·2	mod. W × S swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.^{3}							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1289	12	0	—	−0·21	33·82	27·19	1·33	—	0·18	28·8	7·90	**N 50 V**	100–0	**2008**		
		5	—	−0·21	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·21	33·85	27·21	1·33	—	0·17	26·5	—	,,	100–50			
		20	—	−0·21	33·85	27·21	1·33	—	0·18	26·6	7·82	,,	250–100			
		30	—	−0·21	33·86	27·21	1·33	—	0·17	29·0	—	,,	500–250			
		40	—	−0·21	33·86	27·21	1·35	—	0·18	28·4	7·83	,,	750–500			
		50	—	−1·57	34·21	27·55	2·36	—	0·16	38·9	—	,,	1000–750	—	**2153**	
		60	—	−1·64	34·22	27·55	2·09	—	0·18	44·0	7·32	**NHP**	50–0	**2145**	**2150**	
		80	—	−1·61	34·23	27·57	2·20	—	0·20	45·0	—	**CWS**	0			
		100	—	−1·50	34·28	27·61	2·22	—	0·13	47·0	6·87	,,	5			
		150	—	−0·41	34·42	27·67	2·55	—	0·04	57·9	5·78	,,	10			
		200	—	1·12	34·68	27·80	2·66	—	0·00	68·4	4·42	,,	20			
		300	—	1·43	34·76	27·84	2·74	—	0·00	75·3	4·19	,,	50			
		400	—	1·42	34·76	27·84	2·55	—	0·00	82·4	4·14	,,	100			
		600^1	594	1·23	34·76	27·86	2·66	—	—	86·4	3·94	**N 70 B**	137–0	**2358**	**0020**	KT
		800^1	—	1·11	34·76	27·86	2·76	—	—	90·0	4·02	**N 100 B**				
		1000^1	1008	0·97	34·75	27·87	2·76	—	—	94·7	4·21	**N 70 B**	500–170	**2358**	**0028**	DGP
		1500^1	—	0·71	34·73	27·87	2·89	—	—	102·5	4·19	**N 100 B**				
		1990^2	2001	0·52	34·72	27·87	2·76	—	—	110·4	4·37	**N 100 H**	0–5	**2358**	**0030**	
		2490^2	—	0·34	34·71	27·88	2·87	—	—	110·7	4·40					
		2990^2	2977	0·22	34·71	27·89	2·89	—	—	114·7	4·58					
		3480^2	—	0·10	34·71	27·89	2·81	—	—	106·9	4·62					
1290	12	0	—	−0·55	33·79	27·19	—	—	—	—	—	**N 50 V**	100–0	0905		
												NHP	50–0	—	0924	
												N 70 B	146–0	0931	0951	KT. **N 70 B** net torn
												N 100 B				
1291	13	0	—	−1·05	33·52	26·98	1·54	—	0·34	23·0	8·05	**N 50 V**	100–0	**2012**		
		5	—	−1·05	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·06	33·52	26·98	1·56	—	0·34	23·4	—	,,	100–50			
		20	—	−1·06	33·52	26·98	1·52	—	0·34	25·1	7·98	,,	250–100			
		30	—	−1·07	33·52	26·98	1·48	—	0·33	26·6	—	,,	500–250			
		40	—	−1·54	34·05	27·42	2·19	—	0·21	32·1	7·59	,,	750–500			
		50	—	−1·61	34·13	27·48	2·19	—	0·25	35·1	—	,,	1000–750	—	**2146**	
		60	—	−1·63	34·17	27·52	2·30	—	0·26	38·4	7·26	**NHP**	50–0	**2150**	**2155**	
		80	—	−1·60	34·22	27·55	2·40	—	0·26	41·9	—	**CWS**	0			
		100	—	−1·41	34·25	27·58	2·40	—	0·11	41·1	6·82	,,	5			
		150	—	0·15	34·46	27·68	2·72	—	0·00	54·6	5·39	,,	10			
		200	—	1·22	34·63	27·76	2·78	—	0·00	64·7	4·42	,,	20			
		300	—	1·60	34·72	27·80	2·79	—	0·00	69·3	4·19	,,	50			
		400	—	1·56	34·75	27·83	2·83	—	0·00	72·1	4·21	,,	100			
		590^1	589	1·43	34·76	27·84	2·79	—	—	75·8	4·06	**N 70 B**	146–0	**2305**	**2325**	KT
		790^1	—	1·24	34·76	27·85	2·79	—	—	82·3	4·15	**N 100 B**				
		990^1	—	1·11	34·75	27·86	2·93	—	—	91·5	4·22	**N 70 B**	490–170	**2305**	**2335**	DGP
		1490^1	1493	0·78	34·73	27·87	2·97	—	—	94·9	4·39	**N 100 B**				
		1990^2	2000	0·61	34·70	27·86	2·98	—	—	99·1	4·51	**N 100 H**	0–5	**2307**	**2336**	
		2490^2	—	0·40	34·70	27·87	2·98	—	—	104·8	4·51					
		2990^2	2990	0·30	34·70	27·87	2·98	—	—	106·5	4·64					
		3490^2	—	0·17	34·70	27·88	3·12	—	—	102·6	4·73					
		3990^2	3982	0·08	34·70	27·89	2·97	—	—	107·7	4·73					
1292	13	0	—	−1·20	33·49	26·96	—	—	—	—	—	**N 50 V**	100–0	0910		
												NHP	50–0	—	0925	
												N 70 B	91–0	0950	1010	KT
												N 100 B				
												N 70 B	310–140	0950	1020	DGP
												N 100 B				
												N 100 H	0–5	0950	1022	
1293	14	0	—	−0·50	33·70	27·10	1·65	—	0·24	21·4	7·84	**N 50 V**	100–0	**2016**		
		5	—	−0·50	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·50	33·70	27·10	1·54	—	0·23	25·9	—	,,	100–50			
		20	—	−0·50	33·70	27·10	1·60	—	0·24	26·6	7·82	,,	250–100			
		30	—	−0·50	33·70	27·10	1·65	—	0·23	26·5	—	,,	500–250			
		40	—	−0·50	33·70	27·10	1·63	—	0·24	26·1	7·77	,,	750–500			
		50	—	−0·50	33·70	27·10	1·56	—	0·24	26·4	—	,,	1000–750	—	**2155**	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1293 *cont.*	70° 08·4′ S, 140° 26′ W	1934 27–28 ii											
1294	69° 05·9′ S, 137° 28·2′ W	28 ii	0900	4486*	N × W	20	N × W	4	os	992·0	−1·1	−1·4	low NNW swell
1295	68° 01·4′ S, 134° 14·8′ W	28 ii	2000	4391*	N × W	19	N × W	4	om	988·1	0·0	0·0	mod. N × W swell
1296	69° 06·6′ S, 131° 42·6′ W	1 iii	0900	4029*	NW × N	15	NW × N	3	os	981·8	0·3	0·2	mod. NNW swell
1297	70° 25·2′ S, 129° 15·7′ W	1 iii	2000	3870*	NW × W	9	NW × W	2	oms	982·1	−1·0	−1·0	low NW × W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
1293	14	60	—	−0·51	33·70	27·10	1·63	—	0·24	27·5	7·81	**NHP**	50–0	**2153**	**2202**	
cont.		80	—	−1·60	34·10	27·46	2·30	—	0·28	38·0	—	**CWS**	0			
		100	—	−1·17	34·22	27·54	2·20	—	0·19	40·7	6·71	,,	5			
		150	—	1·11	34·56	27·70	2·66	—	0·07	55·4	4·55	,,	10			
		200	—	1·62	34·66	27·75	2·66	—	0·00	64·9	4·16	,,	20			
		300	—	1·75	34·69	27·76	2·66	—	0·00	70·4	4·11	,,	50			
		400	—	1·74	34·72	27·79	2·66	—	0·00	74·1	4·12	,,	100			
		600^1	593	1·54	34·74	27·82	2·66	—	—	77·9	4·02	**N 70 B**	118–0	**2336**	**2356**	KT
		800^1	—	1·41	34·76	27·84	2·76	—	—	84·0	4·05	**N 100 B**				
		1000^1	—	1·27	34·74	27·84	2·76	—	—	89·9	4·16	**N 70 B**	400–160	**2336**	**0006**	DGP
		1500^1	1502	0·92	34·72	27·85	2·76	—	—	96·1	4·28	**N 100 B**				
		1990^2	2000	0·70	34·70	27·85	2·78	—	—	103·9	4·43	**N 100 H**	0–5	**2336**	**0006**	
		2490^2	—	0·50	34·70	27·86	2·83	—	—	108·6	4·46					
		2990^2	2980	0·33	34·70	27·87	2·83	—	—	111·5	4·58					
		3480^2	—	0·20	34·70	27·88	2·70	—	—	113·2	4·56					
		3980^2	3984	0·09	34·70	27·89	2·87	—	—	110·5	4·84					
1294	14	0	—	−0·20	33·79	27·17	—	—	—	—	—	**N 50 V**	100–0	0906		
												NHP	50–0	—	0921	
												N 70 B	137–0	0928	0948	KT
												N 100 B				
1295	15	0	—	−0·10	33·69	27·08	1·62	—	0·29	22·5	7·82	**N 50 V**	100–0	**2014**		
		5	—	−0·10	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·10	33·69	27·08	1·60	—	0·28	21·6	—	,,	100–50			
		20	—	−0·10	33·69	27·08	1·71	—	0·28	21·7	7·76	,,	250–100			
		30	—	−0·10	33·69	27·08	1·62	—	0·27	20·9	—	,,	500–250			
		40	—	−0·10	33·69	27·08	1·63	—	0·26	22·1	7·74	,,	750–500			
		50	—	−0·13	33·70	27·09	1·69	—	0·26	22·2	—	,,	1000–750	—	**2141**	
		60	—	−0·67	33·87	27·25	2·24	—	0·26	30·8	7·69	**NHP**	50–0	**2147**	**2152**	
		80	—	−1·51	33·98	27·37	2·45	—	0·39	33·8	—	**CWS**	0			
		100	—	−1·21	34·08	27·44	2·57	—	0·19	38·7	7·00	,,	5			
		150	—	1·20	34·41	27·58	2·89	—	0·00	53·1	4·69	,,	10			
		200	—	1·82	34·57	27·66	2·97	—	0·00	59·2	4·08	,,	20			
		300	—	1·93	34·65	27·71	2·97	—	0·00	62·3	4·03	,,	50			
		400	—	1·94	34·70	27·76	2·81	—	0·00	68·3	4·03	,,	100			
		600^1	597	1·82	34·74	27·80	2·81	—	—	71·5	4·04	**N 70 B**	84–0	**2250**	**2310**	KT
		800^1	—	1·67	34·75	27·82	2·87	—	—	74·3	4·18	**N 100 B**				
		1000^1	—	1·51	34·75	27·84	2·87	—	—	78·6	4·23	**N 70 B**	310–150	**2250**	**2320**	DGP
		1500^1	1504	1·11	34·75	27·86	2·87	—	—	82·4	4·41	**N 100 B**				
		1990^2	1999	0·81	34·74	27·87	2·97	—	—	90·0	4·49	**N 100 H**	0–5	**2250**	**2320**	
		2490^2	—	0·64	34·72	27·86	2·85	—	—	93·5	4·43					
		2980^2	2985	0·43	34·72	27·88	2·74	—	—	98·4	4·66					
		3480^2	—	0·31	34·71	27·88	2·93	—	—	102·2	4·56					
		3980^2	3965	0·25	34·71	27·89	2·93	—	—	113·4	4·78					
1296	15	0	—	−0·50	33·79	27·18	—	—	—	—	—	**N 50 V**	100–0	0908		+ 10 hours
												NHP	50–0	—	0930	
												N 70 B	109–0	0936	0956	KT
												N 100 B				
1297	16	0	—	−1·67	33·59	27·06	1·63	—	0·13	42·1	7·78	**N 50 V**	100–0	**2013**		
		5	—	−1·67	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·68	33·59	27·06	1·56	—	0·13	42·2	—	,,	100–50			
		20	—	−1·67	33·59	27·06	1·71	—	0·12	45·8	7·79	,,	250–100			
		30	—	−1·66	33·59	27·06	1·75	—	0·12	45·3	—	,,	500–250			
		40	—	−1·63	33·77	27·19	1·90	—	0·10	45·8	7·49	,,	750–500			
		50	—	−1·63	34·04	27·41	2·43	—	0·09	52·2	—	,,	1000–750	—	**2155**	
		60	—	−1·65	34·10	27·46	2·51	—	0·08	55·9	6·68	**NHP**	50–0	**2140**	**2145**	
		80	—	−1·63	34·16	27·51	2·53	—	0·10	57·7	—	**CWS**	0			
		100	—	−1·57	34·20	27·54	2·57	—	0·09	58·5	6·30	,,	5			
		150	—	−1·12	34·31	27·62	2·68	—	0·00	62·9	5·95	,,	10			
		200	—	−0·18	34·43	27·68	2·68	—	0·00	65·2	5·28	,,	20			
		300	—	1·23	34·65	27·77	2·74	—	0·00	69·8	4·39	,,	50			
		400	—	1·53	34·70	27·79	2·74	—	0·00	75·2	4·19	,,	100			
		600^1	595	1·43	34·73	27·82	2·76	—	—	79·3	4·14	**N 70 B**	164–0	**2233**	**2253**	KT
		800^1	—	1·27	—	—	2·79	—	—	—	4·34	**N 100 B**				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1297 *cont.*	70° 25·2′ S, 129° 15·7′ W	1934 1 iii											
1298	From 69° 15·7′ S, 125° 56·3′ W to 69° 16·2′ S, 125° 36·3′ W	2 iii	1100	3703*	W × N	18	W × N	3	c	988·9	−0·3	−1·4	mod. WNW swell
			1500	—	W × S	18	W × S	4	c	991·8	−0·3	−1·4	mod. W × N swell
1299	68° 45·3′ S, 123° 56·8′ W	2 iii	2000	4201*	W × S	19	W × S	4	c	997·8	−0·6	−1·1	mod. W × N swell
1300	67° 53·7′ S, 120° 57·2′ W	3 iii	0900	3921*	NW	27	NW	4	ors	1001·3	−0·5	−0·6	mod. NW swell
1301	67° 06·9′ S, 117° 41·5′ W	3–4 iii	2000	4437*	W	19	W	4	c	1000·2	1·0	0·9	mod. W swell
			0000	—	W	19	W	4	c	1000·5	0·6	−0·6	mod. W swell
1302	66° 29·9′ S, 114° 57·8′ W	4 iii	0900	4755*	W × S	28	W × S	6	oqrs	1001·2	0·9	0·0	heavy W × S swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1297 *cont.*	16	1000^1	1006	1·12	34·74	27·85	2·79	—	—	87·2	4·31	**N 70 B**	520–200	**2233**	**2303**	Depths of nets estimated
		1480^2	1488	0·91	34·74	27·87	2·89	—	—	89·9	4·40	**N 100 B**				
		1980^2	—	0·69	34·73	27·87	2·89	—	—	101·1	4·41	**N 100 H**	0–5	**2233**	**2305**	
		2470^2	2467	0·51	34·72	27·87	2·89	—	—	104·2	4·58					
		2960^2	—	0·42	34·71	27·88	2·89	—	—	105·1	4·56					
		3460^2	3453	0·39	34·71	27·88	2·89	—	—	115·3	4·65					
1298	17	0	—	−0·40	33·60	27·02	—	—	—	—	—	**N 450 H**	1000(−0)	1115	1515	Depth estimated. Bucket of net leaking
1299	17	0	—	−0·40	33·49	26·93	1·81	—	0·14	24·3	7·69	**N 50 V**	100–0	**2016**		
		5	—	−0·39	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·39	33·50	26·94	1·77	—	0·14	25·9	—	,,	100–50			
		20	—	−0·39	33·50	26·94	1·73	—	0·14	26·0	7·69	,,	250–100			
		30	—	−0·40	33·50	26·94	1·79	—	0·14	26·7	—	,,	500–250			
		40	—	−1·44	33·90	27·30	2·51	—	0·10	40·3	7·18	,,	750–500			
		50	—	−1·55	33·98	27·37	2·51	—	0·10	46·1	—	,,	1000–750	—	**2140**	
		60	—	−1·61	34·08	27·45	2·55	—	0·12	47·0	6·85	**NHP**	50–0	**2142**	**2147**	
		80	—	−1·55	34·15	27·51	2·59	—	0·11	42·9	—	**CWS**	0			
		100	—	−0·91	34·25	27·56	2·62	—	0·08	47·0	6·09	,,	5			
		150	—	0·39	34·44	27·66	2·74	—	0·04	52·4	5·07	,,	10			
		200	—	1·30	34·58	27·71	2·98	—	0·00	60·8	4·31	,,	20			
		300	—	1·83	34·68	27·75	2·98	—	0·00	68·0	4·03	,,	50			
		400	—	1·78	34·70	27·78	2·98	—	0·00	73·4	4·05	,,	100			
		600^1	592	1·70	34·74	27·81	2·89	—	—	78·3	4·06	**N 70 B**	86–0	**2302**	**2322**	KT
		800^1	—	1·52	34·74	27·83	2·85	—	—	83·0	4·11	**N 100 B**				
		1000^1	—	1·33	34·74	27·84	2·66	—	—	89·1	4·23	**N 70 B**	330–150	**2302**	**2332**	**N 100 B** probably closed early. Depths of nets estimated
		1500^1	1500	0·99	34·72	27·84	2·87	—	—	96·6	4·41	**N 100 B**				
		1990^2	—	0·73	34·71	27·86	2·89	—	—	102·0	4·39	**N 100 H**	0–5	**2302**	**2322**	Net torn
		2490^2	—	0·53	34·70	27·86	2·93	—	—	108·4	4·44					
		2990^2	2993	0·40	34·70	27·87	2·87	—	—	109·1	4·62					
		3490^2	—	0·34	34·70	27·87	2·87	—	—	108·8	4·49					
		3990^2	3985	0·30	34·70	27·87	2·91	—	—	113·9	4·59					
1300	18	0	—	0·25	33·86	27·19	—	—	—	—	—	**N 50 V**	100–0	0908		
												NHP	50–0	—	0922	
												N 70 B	82–0	0929	0949	KT
												N 100 B				
1301	18	0	—	0·22	33·77	27·12	1·67	—	0·18	21·1	7·67	**N 50 V**	100–0	**2013**		
		5	—	0·22	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·22	33·77	27·12	1·71	—	0·18	20·1	—	,,	100–50			
		20	—	0·22	33·77	27·12	1·73	—	0·18	21·8	7·65	,,	250–100			
		30	—	0·22	33·77	27·12	1·77	—	0·16	22·1	—	,,	500–250			
		40	—	0·22	33·77	27·12	1·67	—	0·17	21·5	7·64	,,	750–500			
		50	—	0·22	33·77	27·12	1·77	—	0·17	22·9	—	,,	1000–750			
		60	—	0·02	33·80	27·15	1·82	—	0·18	23·5	7·60	**NHP**	50–0	—	**2142**	
		80	—	−1·50	34·00	27·38	2·32	—	0·25	35·9	—	**CWS**	0			
		100	—	−1·06	34·10	27·45	2·45	—	0·21	37·6	6·79	,,	5			
		150	—	0·80	34·36	27·57	2·78	—	0·00	48·0	5·20	,,	10			
		200	—	1·41	34·50	27·63	3·00	—	0·00	57·5	4·53	,,	20			
		295	—	1·73	34·60	27·69	2·89	—	0·00	60·5	4·13	,,	50			
		395	—	1·93	34·64	27·71	2·89	—	0·00	65·5	4·00	,,	100			
		590^1	593	1·86	34·70	27·77	2·89	—	—	68·4	3·96	**N 70 B**	108–0	**2335**	**2355**	KT
		790^1	—	1·75	34·72	27·79	2·83	—	—	73·7	4·06	**N 100 B**				
		990^1	—	1·61	34·73	27·81	2·83	—	—	75·9	4·18	**N 70 B**	380–200	**2335**	**0005**	DGP
		1480^2	1476	1·26	34·73	27·83	2·78	—	—	87·2	4·34	**N 100 B**				
		1970^3	1963	0·99	34·71	27·84	2·89	—	—	90·4	4·45	**N 100 H**	0–5	**2336**	**0006**	
		2460^3	—	0·75	34·70	27·85	2·89	—	—	98·7	4·50					
		2950^3	2954	0·54	34·70	27·86	2·98	—	—	106·0	4·61					
		3450^3	—	0·37	34·70	27·87	2·98	—	—	107·2	4·73					
		3940^3	3943	0·29	34·70	27·87	2·98	—	—	109·2	4·71					
1302	18	0	—	0·70	33·70	27·04	—	—	—	—	—	**N 50 V**	100–0	0912		+ 9 hours
												NHP	50–0	—	0931	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1302 *cont.*	66° 29·9′ S, 114° 57·8′ W	1934 4 iii											
1303	67° 04·8′ S, 111° 50′ W	4 iii	2000	4570*	SW × W	24	SW × W	6	o	996·5	0·0	0·0	heavy SW × W swell
1304	67° 47·3′ S, 108° 47·7′ W	5 iii	0900	4159*	W × S	22	W × S	4	omrs	982·9	0·5	0·0	heavy W × S swell
1305	68° 22·6′ S, 105° 57′ W	5–6 iii	2000	4437*	SSE	19	SSE	4	c	984·0	−0·2	−1·1	mod. W × N swell
1306	69° 40·6′ S, 97° 03·7′ W	7 iii	0903	4203*	S × W	20	S × W	3	b	990·6	−7·9	−7·9	low S × W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1302 *cont.*	18											**N 100 B**	115–0	0949	1009	KT
												N 70 B	520–160	0949	1019	DGP
												N 100 B				
1303	19	0	—	0·47	33·73	27·08	2·05	—	0·27	15·9	7·67	**N 50 V**	100–0	**2017**		
		5	—	0·47	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·47	33·73	27·08	2·03	—	0·27	16·2	—	,,	100–50			
		20	—	0·47	33·73	27·08	2·01	—	0·28	16·9	7·66	,,	250–100			
		30	—	0·47	33·73	27·08	2·01	—	0·28	17·2	—	,,	500–250			
		40	—	0·46	33·73	27·08	2·01	—	0·24	17·7	7·66	,,	750–500			
		50	—	0·45	33·73	27·08	2·01	—	0·29	18·3	—	,,	1000–750	—	**2146**	
		60	—	0·25	33·77	27·12	2·07	—	0·27	20·4	7·63	**NHP**	50–0	**2147**	**2152**	
		80	—	−1·53	33·98	27·37	2·60	—	0·32	28·0	—	**CWS**	0			
		100	—	−1·54	34·00	27·38	2·60	—	0·32	31·7	7·21	,,	5			
		150	—	0·94	34·33	27·53	2·97	—	0·00	44·6	5·25	,,	10			
		200	—	1·55	34·43	27·57	3·12	—	0·00	50·1	4·56	,,	20			
		300	—	1·84	34·55	27·65	3·12	—	0·00	55·2	4·15	,,	50			
		400	—	1·95	34·61	27·69	3·12	—	0·00	60·0	3·98	,,	100			
		600^1	593	1·97	34·69	27·74	3·02	—	—	61·6	3·93	**N 100 B**	132–0	**2306**	**2326**	KT
		800^1	—	1·86	34·70	27·77	3·02	—	—	68·5	4·06	**N 70 B**	450–220	**2306**	**2336**	DGP. **N 100 B** possibly closed prematurely
		1000^1	—	1·72	34·70	27·78	2·81	—	—	74·0	4·16	**N 100 B**				
		1500^1	1494	1·33	34·71	27·82	2·97	—	—	77·2	4·29	**N 100 H**	0–5	**2306**	**2336**	
		2000^2	2002	1·01	34·71	27·84	2·97	—	—	81·9	4·27					
		2490^2	—	0·78	34·70	27·85	2·97	—	—	89·1	4·53					
		2990^2	2994	0·57	34·70	27·86	2·97	—	—	90·6	4·47					
		3490^2	—	0·38	34·70	27·87	2·97	—	—	96·5	4·66					
		3990^2	3982	0·29	34·70	27·87	2·97	—	—	101·4	4·64					
1304	20	0	—	0·80	33·81	27·13	—	—	—	—	—	**N 50 V**	100–0	0907		
												NHP	50–0	—	0918	
												N 70 B	68–0	0931	0951	KT
												N 100 B				
1305	20	0	—	0·63	33·74	27·08	1·79	—	0·21	19·4	7·58	**N 50 V**	100–0	**2008**		+8 hours
		5	—	0·64	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·66	33·74	27·07	1·77	—	0·21	19·2	—	,,	100–50			
		20	—	0·66	33·74	27·07	1·71	—	0·21	20·6	7·58	,,	250–100			
		30	—	0·66	33·74	27·07	1·79	—	0·21	20·2	—	,,	500–250			
		40	—	0·66	33·74	27·07	1·77	—	0·21	21·6	7·54	,,	750–500			
		50	—	0·63	33·74	27·08	1·81	—	0·21	22·5	—	,,	1000–750	—	**2146**	
		60	—	−1·20	33·93	27·31	2·51	—	0·20	34·7	7·29	**NHP**	50–0	**2128**	**2132**	
		80	—	−1·31	34·02	27·39	2·68	—	0·16	38·7	—	**CWS**	0			
		100	—	−0·70	34·15	27·48	2·68	—	0·11	44·1	6·43	,,	5			
		150	—	0·77	34·34	27·56	2·93	—	0·00	46·6	5·26	,,	10			
		195	—	1·31	34·43	27·59	3·00	—	0·00	52·0	4·64	,,	20			
		290	—	1·84	34·58	27·67	3·10	—	0·00	58·6	4·11	,,	50			
		390	—	1·95	34·64	27·71	2·98	—	0·00	65·2	3·98	,,	100			
		580^1	563	1·95	34·69	27·74	2·98	—	—	68·5	3·94	**N 70 B**	122–0	**2353**	**0013**	KT
		780^1	—	1·85	34·72	27·78	2·93	—	—	73·4	4·07	**N 100 B**				
		970^1	—	1·71	34·73	27·80	2·93	—	—	75·5	4·10	**N 70 B**	450–180	**2353**	**0023**	DGP. **N 100 B** did not close
		1450^1	1474	1·31	34·71	27·82	2·93	—	—	79·9	4·29	**N 100 B**	450–180(–0)			
		1980^2	1976	1·00	34·70	27·83	2·93	—	—	82·8	4·40	**N 100 H**	0–5	**2355**	**2357**	
		2470^2	—	0·76	34·70	27·85	2·93	—	—	94·4	4·42					
		2960^2	2966	0·55	34·70	27·86	3·02	—	—	102·2	4·56					
		3460^2	—	0·39	34·70	27·87	3·02	—	—	106·9	4·66					
		3950^2	3942	0·29	34·70	27·87	3·02	—	—	109·9	4·61					
1306	21	0	—	−0·50	33·63	27·05	1·63	—	0·18	19·3	7·60	**N 50 V**	100–0	0913		
		5	—	−0·50	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·50	33·63	27·05	1·69	—	0·18	21·5	—	,,	100–50			
		20	—	−0·50	33·63	27·05	1·69	—	0·18	18·0	7·59	,,	250–100			
		30	—	−0·50	33·63	27·05	1·77	—	0·18	19·2	—	,,	500–250			
		40	—	−1·23	33·73	27·15	1·94	—	0·18	20·5	7·46	,,	750–500			
		50	—	−1·44	33·98	27·37	2·53	—	0·21	31·2	—	,,	1000–750			
		60	—	−1·50	34·02	27·40	2·41	—	0·24	33·2	6·96	**NHP**	50–0	—	1054	
		80	—	−1·30	34·10	27·45	2·40	—	0·22	35·4	—	**CWS**	0			
		100	—	−1·10	34·16	27·50	2·59	—	0·18	36·5	6·42	,,	5			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1306 *cont.*	69° 40·6′ S, 97° 03·7′ W	1934 7 iii											
1307	69° 00·6′ S, 95° 27·1′ W	7 iii	2200	4320*	Lt airs	1–3	—	1	bc	983·7	−7·2	−7·2	low conf. swell
1308	68° 33·1′ S, 91° 50·9′ W	8 iii	0900	4151*	S × E	14	S × E	2	b	980·8	−7·2	−7·2	low S × E swell
1309	67° 45·9′ S, 89° 23·5′ W	8–9 iii	2000 0000	4128* —	S × W S × W	16 19	S × W S × W	2 3	osp csp	983·0 983·6	−9·3 −8·9	−9·3 −9·4	low conf. swell mod. S × W swell
1310	67° 12·9′ S, 86° 53·8′ W	9 iii	0900	4276*	S × W	10	S × W	2	bc	981·4	−6·4	−7·0	low SW × S swell
1311	67° 18·8′ S, 82° 54′ W	9 iii	2200	4201*	S × W	24	S × W	4	osp	982·8	−6·7	−7·2	mod. S × W swell
1312	68° 18′ S, 79° 33·8′ W	10 iii	1530 2000	3798* —	S S	16 12	S S	3 2	csp csp	986·6 988·1	−10·0 − 8·9	−10·3 − 9·4	no swell no swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	Mg.—atom m.^{3}				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1306 *cont.*	21	145	—	0·71	34·42	27·61	2·79	—	0·00	49·4	4·78	**CWS**	10			
		195	—	1·62	34·54	27·66	2·89	—	0·00	57·1	4·09	,,	50			
		290	—	1·89	34·66	27·73	2·89	—	0·00	61·3	3·96	,,	100			
		385	—	1·86	34·70	27·77	2·89	—	0·00	69·2	4·01	**N 70 B**	90–0	1220	1240	KT
		580^1	565	1·77	34·73	27·80	3·29	—	—	70·9	3·96	**N 100 B**				
		770^1	—	1·65	34·73	27·81	2·89	—	—	77·1	4·03	**N 70 B**	340–170	1220	1250	DGP
		970^1	—	1·53	34·73	27·81	2·83	—	—	79·7	4·24	**N 100 B**				
		1450^1	1464	1·18	34·72	27·83	2·79	—	—	83·3	4·32	**N 100 H**	0–5	1219	1250	
		1970^2	1966	0·89	34·72	27·85	2·83	—	—	89·8	4·35	**NH**	0	1455		
		2460^2	—	0·69	34·71	27·86	2·97	—	—	94·5	4·37					
		2950^2	2940	0·48	34·70	27·86	3·02	—	—	98·4	4·50					
		3440^2	—	0·37	34·70	27·87	3·02	—	—	102·5	4·44					
		3930^2	3953	0·30	34·70	27·87	3·02	—	—	108·8	4·54					
1307	22	0	—	0·05	33·69	27·07	—	—	—	—	—	**N 50 V**	100–0	2203	—	+7 hours
												NHP	50–0	—	2214	
												N 70 B	86–0	2222	2242	KT
												N 100 B				
												N 100 H	0–5	2220	2244	
1308	22	0	—	−0·75	33·30	26·78	—	—	—	—	—	**N 50 V**	100–0	0907		
												NHP	50–0	—	0920	
												N 70 B	135–0	0932	0952	KT
												N 100 B				
1309	23	0	—	0·21	33·45	26·87	1·63	—	0·18	9·3	7·59	**N 50 V**	100–0	2024	—	+6 hours
		5	—	0·23	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·25	33·45	26·87	1·67	—	0·18	13·6	—	,,	100–50			
		20	—	0·27	33·45	26·87	1·65	—	0·18	14·1	7·66	,,	250–100			
		30	—	0·38	33·49	26·89	1·81	—	0·18	16·0	—	,,	500–250			
		40	—	0·30	33·63	27·01	1·84	—	0·17	17·4	7·60	,,	750–500			
		50	—	−1·18	33·88	27·28	2·36	—	0·16	27·8	—	,,	1000–750	—	2205	
		60	—	−1·49	33·94	27·33	2·41	—	0·22	30·5	7·21	**NHP**	50–0	2205	2210	
		80	—	−1·46	34·01	27·39	2·55	—	0·29	31·6	—	**CWS**	0			
		100	—	−0·70	34·18	27·50	2·59	—	0·04	41·1	6·15	,,	5			
		150	—	−0·28	34·35	27·62	2·70	—	0·00	55·5	5·62	,,	10			
		195	—	0·60	34·50	27·69	2·81	—	0·00	61·8	4·84	,,	20			
		295	—	1·53	34·64	27·74	2·81	—	0·00	66·8	4·17	,,	50			
		390	—	1·77	34·70	27·78	2·81	—	0·00	57·7	4·04	,,	100			
		590^1	588	1·72	34·73	27·80	2·81	—	—	75·1	3·98	**N 70 B**	106–0	0028	0048	KT
		780^1	—	1·63	34·73	27·81	2·81	—	—	78·6	4·10	**N 100 B**				
		980^1	—	1·51	34·74	27·83	2·81	—	—	80·1	4·14	**N 70 B**	390–220	0028	0058	DGP
		1460^1	1460	1·20	34·73	27·84	2·81	—	—	85·3	4·29	**N 100 B**				
		1980^2	1991	0·92	34·71	27·85	2·68	—	—	93·0	4·17	**N 100 H**	0–5	0028	0059	
		2480^2	—	0·69	34·71	27·86	2·95	—	—	98·4	4·26					
		2970^2	2970	0·47	34·71	27·87	3·00	—	—	104·1	4·24					
		3470^2	—	0·34	34·70	27·87	3·00	—	—	108·3	4·52					
		3960^2	3956	0·29	34·70	27·87	3·00	—	—	110·0	4·38					
1310	23	0	—	1·00	33·70	27·02	—	—	—	—	—	**N 50 V**	100–0	0907		
												NHP	50–0	—	0919	
												N 70 B	133–0	0930	0940	KT
												N 100 B				
1311	24	0	—	−0·90	33·30	26·79	—	—	—	—	—	**N 50 V**	100–0	2211		
												NHP	50–0	—	2222	
												N 70 B	180–0	2230	2250	KT
												N 100 B				
												N 100 H	0–5	2231	2252	
1312	25	0	—	−1·31	33·03	26·59	2·09	40·84	0·19	29·1	7·94	**N 50 V**	100–0	1535		
		5	—	−1·30	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·29	33·03	26·59	2·09	—	0·18	30·7	—	,,	100–50			
		20	—	−1·20	33·04	26·60	2·13	34·55	0·17	30·8	7·90	,,	250–100			
		30	—	−1·30	33·80	27·21	2·41	—	0·14	30·7	—	,,	500–250			
		40	—	−1·45	33·90	27·30	2·41	30·63	0·14	30·3	7·35	,,	750–500			
		50	—	−1·57	33·98	27·37	2·55	—	0·10	39·6	—	,,	1000–750	—	1723	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1312 *cont.*	68° 18′ S, 79° 33·8′ W	1934 10 iii											
1313	66° 02·4′ S, 79° 22·2′ W	11 iii	0900	4150*	SE	8	SE	2	c	990·7	−2·5	−3·3	low conf. SE swell
1314	64° 31·5′ S, 79° 14·5′ W	11 iii	2000	4060*	Lt airs	2	—	1	o	991·0	−2·0	−2·5	low conf. swell
1315	62° 55·1′ S, 79° 06·3′ W	12 iii	0900	4899*	Lt airs	1–2	—	0	o	993·3	−1·1	−2·2	low conf. E × S swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	Mg.—atom $m.^3$				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1312 *cont.*	25	60	—	−1·49	34·01	27·39	2·57	—	0·19	39·2	7·02	**NHP**	50–0	1727	1730	
		80	—	−1·20	34·14	27·49	2·72	40·84	0·24	44·8	—	**CWS**	0			
		95	—	0·13	34·33	27·57	2·91	—	0·04	50·7	5·34	,,	5			
		145	—	0·81	34·46	27·64	2·91	41·62	0·00	56·3	4·68	,,	10			
		190	—	1·18	34·54	27·69	2·91	44·76	0·00	60·5	4·36	,,	20			
		290	—	1·82	34·65	27·72	2·98	—	0·00	65·7	3·96	,,	50			
		385	—	1·87	34·69	27·75	2·98	41·62	0·00	69·1	3·99	,,	100			
		580^1	539?	1·74	34·73	27·80	2·97	47·90	—	71·4	3·98	**N 70 B**	128–0	**1907**	**1927**	KT
		770^1	—	1·63	34·74	27·82	2·97	43·98	—	77·9	4·07	**N 100 B**				
		960^1	959	1·46	34·74	27·83	2·87	—	—	87·4	4·18	**N 70 B**	440–210	**1907**	**1937**	DGP
		1440^2	1430	1·14	34·73	27·84	2·95	44·76	—	88·6	4·26	**N 100 B**				
		1920^2	—	0·86	34·71	27·85	2·95	—	—	96·4	4·34	**N 100 H**	0–5	**1907**	**1937**	
		2390^2	2402	0·62	34·70	27·86	2·97	47·12	—	96·7	4·41					
		2870^2	—	0·45	34·70	27·87	2·97	—	—	103·8	4·53					
		3350^2	3343	0·33	34·70	27·87	3·02	44·76	—	110·7	4·50					
1313	25	0	—	1·19	33·71	27·02	1·69	—	0·19	18·9	7·42	**N 50 V**	100–0	0907		
		5	—	1·19	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	1·21	33·75	27·05	1·69	—	0·20	17·9	—	,,	100–50			
		20	—	1·21	33·75	27·05	1·69	—	0·20	17·7	7·43	,,	250–100			
		30	—	1·23	33·78	27·08	1·69	—	0·19	17·5	—	,,	500–250			
		40	—	0·80	33·80	27·12	1·79	—	0·19	19·5	7·55	,,	750–500			
		50	—	−0·62	33·92	27·29	2·13	—	0·12	24·8	—	,,	1000–750			
		60	—	−0·67	33·98	27·34	2·15	—	0·11	26·8	7·72	**NHP**	50–0	—	1032	
		80	—	−1·16	34·01	27·38	2·30	—	0·14	29·9	—	**CWS**	0			
		100	—	−1·15	34·08	27·44	2·43	—	0·19	35·1	6·84	,,	5			
		150	—	1·11	34·42	27·58	2·72	—	0·00	58·9	4·60	,,	10			
		195	—	1·49	34·54	27·67	2·76	—	0·00	64·1	4·18	,,	20			
		295	—	1·84	34·64	27·72	2·74	—	0·00	69·6	4·02	,,	50			
		390	—	1·94	34·69	27·74	2·87	—	0·00	75·3	3·98	,,	100			
		590^1	597	1·85	34·72	27·78	2·87	—	—	79·2	3·88	**N 70 B**	146–0	1045	1105	KT
		780^1	—	1·76	34·73	27·80	2·87	—	—	79·9	4·07	**N 100 B**				
		980^1	969	1·62	34·74	27·82	2·87	—	—	86·7	4·09					
		1470^1	—	1·26	34·75	27·85	2·78	—	—	89·1	4·28					
		1960^1	1967	0·97	34·73	27·85	2·85	—	—	96·0	4·34					
1314	26	0	—	1·41	33·80	27·08	1·69	25·49	0·25	12·8	7·46	**N 50 V**	100–0	**2010**		
		5	—	1·41	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	1·41	33·80	27·08	1·67	—	0·25	12·4	—	,,	100–50			
		20	—	1·33	33·80	27·08	1·77	27·49	0·25	12·8	7·47	,,	250–100			
		30	—	1·30	33·80	27·08	1·75	—	0·24	13·9	—	,,	500–250			
		40	—	1·30	33·80	27·08	1·77	31·41	0·25	13·7	7·47	,,	750–500			
		50	—	1·29	33·80	27·08	1·82	—	0·25	13·9	—	,,	1000–750	—	**2145**	
		60	—	0·75	33·83	27·15	2·05	32·55	0·22	15·3	7·57	**NHP**	50–0	**2148**	**2152**	
		80	—	−1·13	33·92	27·31	2·38	36·48	0·15	23·7	—	**CWS**	0			
		100	—	−1·40	33·97	27·36	2·40	37·27	0·26	24·4	7·53	,,	5			
		150	—	0·77	34·22	27·45	2·70	40·05	0·00	40·5	5·82	,,	10			
		195	—	1·71	34·37	27·51	2·78	40·84	0·00	46·8	4·76	,,	20			
		295	—	1·87	34·50	27·60	2·89	—	0·00	55·9	4·23	,,	50			
		385	—	1·95	34·56	27·64	2·95	41·98	0·00	58·5	4·02	,,	100			
		590^1	578	2·08	34·68	27·73	2·91	—	—	63·9	3·87	**N 70 B**	126–0	**2259**	**2319**	KT
		790^1	—	2·03	34·71	27·77	2·91	36·48	—	70·4	3·94	**N 100 B**				
		980^1	992	1·90	34·73	27·79	2·87	—	—	76·9	4·06	**N 70 B**	430–210	**2259**	**2330**	DGP
		1490^2	1482	1·55	34·75	27·83	2·79	33·77	—	82·6	4·15	**N 100 B**				
		1980^2	—	1·20	34·75	27·86	2·89	—	—	85·9	4·32	**N 100 H**	0–5	**2259**	**2331**	
		2480^2	2474	0·88	34·73	27·86	2·89	32·55	—	100·1	4·36					
		2970^2	—	0·67	34·73	27·87	2·89	—	—	101·8	4·50					
		3470^2	3471	0·45	34·73	27·89	2·89	34·55	—	111·4	4·55					
1315	26	0	—	4·01	34·05	27·05	2·13	—	0·24	5·1	6·88	**N 50 V**	100–0	0911		
		5	—	4·01	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	4·01	34·05	27·05	2·13	—	0·24	5·1	—	,,	100–50			
		20	—	4·01	34·05	27·05	2·13	—	0·24	4·7	6·88	,,	250–100			
		30	—	4·01	34·05	27·05	2·13	—	0·24	5·1	—	,,	500–250			
		40	—	4·01	34·05	27·05	2·28	—	0·24	4·7	6·87	,,	750–500			
		50	—	4·01	34·05	27·05	2·17	—	0·25	4·7	—	,,	1000–750	—	1031	
		60	—	4·00	34·05	27·05	2·30	—	0·24	5·1	6·88	**NHP**	50–0	1032	1037	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1315 *cont.*	62° 55·1′ S, 79° 06·3′ W	1934 12 iii											
1316	61° 27·1′ S, 78° 58·8′ W	12 iii	2000	4852*	SSW	9	SSW	3	osp	994·8	0·6	0·0	mod. SW swell
1317	59° 55·2′ S, 79° 00·4′ W	13 iii	0900	5004*	SSW	16	SSW	3	o	1000·1	1·7	1·1	mod. conf. SW swell
1318	58° 25·8′ S, 78° 53·8′ W	13 iii	2000	4960*	SW	10	SW × S	2	o	1005·4	2·2	2·0	mod. conf. SSW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³				O₂ c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N₂	Nitrite N₂	Si				From	To	
1315 *cont.*	26	80	—	2·50	34·05	27·19	2·59	—	0·21	13·0	—	**CWS**	0			
		100	—	2·05	34·06	27·24	2·59	—	0·38	17·4	7·11	,,	5			
		150	—	1·86	34·07	27·26	2·59	—	0·00	21·3	6·83	,,	10			
		200	—	1·91	34·10	27·28	2·62	—	0·00	26·6	6·52	,,	20			
		300	—	1·83	34·15	27·33	2·87	—	0·00	27·4	6·06	,,	50			
		400	—	2·10	34·23	27·37	2·97	—	0·00	32·8	5·36	,,	100			
		600^1	606	2·44	34·43	27·50	2·97	—	—	53·0	4·08	**N 70 B**	146–0	1045	1105	KT
		800^1	—	2·33	34·53	27·59	3·17	—	—	66·3	3·79	**N 100 B**				
		1000^1	998	2·25	34·61	27·67	3·17	—	—	69·1	3·76					
		1500^1	—	2·07	34·71	27·76	3·02	—	—	73·7	3·86					
		1990^1	1992	1·69	34·75	27·82	3·08	—	—	85·9	3·98					
1316	27	0	—	4·14	34·03	27·03	2·20	21·42	0·24	<5·0	6·92	**N 50 V**	100–0	**2017**		
		5	—	4·16	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	4·16	34·03	27·03	2·19	—	0·24	<5·0	—	,,	100–50			
		20	—	4·16	34·03	27·03	2·17	28·20	0·24	<5·0	6·92	,,	250–100			
		30	—	4·16	34·03	27·03	2·17	—	0·24	<5·0	—	,,	500–250			
		40	—	4·16	34·03	27·03	2·17	25·70	0·24	<5·0	6·91	,,	750–500			
		50	—	4·16	34·03	27·03	2·19	—	0·22	<5·0	—	,,	1000–750			
		60	—	4·13	34·03	27·03	2·20	21·42	0·23	<5·0	6·91	**NHP**	50–0	—	**2213**	
		80	—	1·92	34·03	27·23	2·55	25·70	0·40	17·1	—	**CWS**	0			
		95	—	1·81	34·04	27·24	2·55	24·27	0·48	19·1	7·07	,,	5			
		145	—	1·66	34·07	27·28	2·55	25·70	0·00	19·8	6·90	,,	10			
		190	—	1·50	34·08	27·30	2·55	28·20	0·00	22·0	6·78	,,	20			
		290	—	1·42	34·11	27·32	2·62	—	0·00	22·2	6·41	,,	50			
		385	—	1·86	34·19	27·36	2·81	34·98	0·00	25·5	5·62	,,	100			
		580^1	561	2·47	34·40	27·47	3·06	34·98	—	41·6	4·31	**N 70 B**	102–0	**2326**	**2346**	KT
		770^1	—	2·31	34·52	27·58	3·19	—	—	52·6	3·94	**N 100 B**				
		960^1	947	2·30	34·60	27·64	3·16	34·98	—	58·9	3·80	**N 70 B**	390–210	**2326**	**2356**	DGP
		1440^1	—	2·06	34·70	27·75	2·98	—	—	61·8	3·93	**N 100 B**				
		1920^1	1959	1·72	34·73	27·80	2·98	25·70	—	68·3	4·15					
		2490^2	2494	1·40	34·74	27·83	2·98	—	—	73·5	4·26					
		2980^2	—	1·10	34·74	27·85	2·93	31·77	—	81·8	4·43					
		3480^2	3475	0·80	34·74	27·87	2·97	—	—	89·1	4·46					
		3980^2	—	0·55	34·74	27·89	3·02	29·63	—	102·3	4·68					
		4480^2	4479	0·47	34·73	27·88	3·02	—	—	105·0	4·59					
1317	28	0	—	5·14	34·05	26·93	1·71	—	0·22	0·0	6·74	**N 50 V**	100–0	0912		
		5	—	5·14	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	5·14	34·05	26·93	1·73	—	0·22	0·0	—	,,	100–50			
		20	—	5·14	34·05	26·93	1·77	—	0·22	0·0	6·72	,,	250–100			
		30	—	5·14	34·05	26·93	1·77	—	0·22	0·0	—	,,	500–250			
		40	—	5·14	34·05	26·93	1·77	—	0·22	0·0	6·77	,,	750–500			
		50	—	5·14	34·05	26·93	1·79	—	0·23	0·0	—	,,	1000–750			
		60	—	4·25	34·19	27·14	2·17	—	0·35	10·0	6·89	**NHP**	50–0	—	1042	
		80	—	4·09	34·19	27·16	2·17	—	0·36	11·3	—	**CWS**	0			
		100	—	3·93	34·17	27·16	2·17	—	0·00	11·7	6·64	,,	5			
		150	—	3·71	34·17	27·18	2·17	—	0·00	13·3	6·62	,,	10			
		200	—	3·48	34·14	27·18	2·17	—	0·00	14·4	6·62	,,	20			
		300	—	3·09	34·13	27·20	2·24	—	0·00	15·5	6·57	,,	50			
		400	—	2·59	34·12	27·24	2·49	—	0·00	18·3	6·45	,,	100			
		600^1	604	2·81	34·26	27·33	2·85	—	—	29·9	5·00	**N 70 B**	128–0	1051	1111	KT
		800^1	—	2·72	34·40	27·45	3·02	—	—	41·4	4·32	**N 100 B**				
		990^1	979?	2·58	34·49	27·53	3·02	—	—	54·1	3·88					
		1490^1	—	2·25	34·66	27·70	3·02	—	—	63·6	3·75					
		1990^1	1991	1·96	34·73	27·78	2·81	—	—	70·9	3·93					
1318	28	0	—	6·54	34·22	26·88	1·50	17·49	0·23	7·9	6·53	**N 50 V**	100–0	**2009**		
		5	—	6·55	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	6·55	34·22	26·88	1·50	—	0·23	13·4	—	,,	100–50			
		20	—	6·55	34·22	26·88	1·50	18·56	0·22	7·0	6·56	,,	250–100			
		30	—	6·55	34·22	26·88	1·56	—	0·24	8·0	—	,,	500–250			
		40	—	6·55	34·22	26·88	1·52	18·56	0·21	<5·0	6·54	,,	750–500			
		50	—	6·55	34·22	26·88	1·56	—	0·21	8·9	—	,,	1000–750	—	**2158**	
		60	—	6·55	34·22	26·88	1·56	19·28	0·23	5·7	6·50	**NHP**	50–0	**2159**	**2204**	
		80	—	5·13	34·24	27·09	1·82	22·13	0·49	14·4	—	**CWS**	0			
		100	—	5·02	34·24	27·10	1·82	20·35	0·55	14·8	6·66	,,	5			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1318 *cont.*	58° 25·8′ S, 78° 53·8′ W	1934 13 iii											
1319	56° 56·1′ S, 78° 46·3′ W	14 iii	0900	4870*	NNW	12	NNW	3	opr	1002·0	4·6	3·0	mod. conf. W swell
1320	55° 45·1′ S, 78° 29·2′ W	14 iii	2000	4468*	NW	25	NW	4	oqr	983·3	6·9	6·1	heavy conf. NW swell
1321	From 4·0 miles S 72° W to 5·6 miles S 75° W of E Tussac Rock, Cockburn Channel, Tierra del Fuego	16 iii	0742	66*	W × N	22	W	5	csp	986·2	5·6	4·2	heavy W swell
1322	52° 32·1′ S, 62° 27·6′ W	21 iii	1000	322*	N × W	25	N × W	4	bc	1010·9	9·2	8·4	mod. N × W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS					Mg.—atom m.³					BIOLOGICAL OBSERVATIONS		TIME		Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1318 *cont.*	28	150	—	4·83	34·27	27·14	1·88	20·35	0·00	14·9	6·53	**CWS**	10			
		195	—	4·76	34·28	27·16	1·86	21·42	0·00	14·4	6·54	,,	20			
		295	—	4·62	—	—	1·86	—	0·00	14·6	6·54	,,	50			
		395	—	4·43	34·25	27·16	1·86	21·42	0·00	14·6	6·46	,,	100			
		590^1	583	3·78	34·21	27·20	2·30	26·06	—	17·4	6·29	**N 70 B**	135–0	**2323**	**2343**	KT
		790^1	—	3·77	34·31	27·28	2·72	—	—	29·9	4·88	**N 100 B**				
		990^1	987	3·14	34·40	27·41	3·02	30·34	—	39·2	4·46	**N 70 B**	440–150	**2323**	**2353**	DGP
		1480^1	—	2·48	34·58	27·62	3·12	—	—	56·2	3·85	**N 100 B**				
		1970^1	1979	2·19	34·72	27·75	3·02	32·13	—	63·3	3·88					
		2360^2	2324	1·95	34·75	27·80	3·02	—	—	73·7	3·94					
		2830^2	—	1·65	34·75	27·83	3·02	33·55	—	80·9	4·19					
		3300^2	3291	1·32	34·75	27·85	3·02	—	—	89·7	4·32					
		3770^2	—	0·93	34·75	27·88	3·02	32·13	—	103·9	4·50					
		4240^2	4295	0·63	34·74	27·88	3·12	—	—	111·2	4·55					
1319	29	0	—	6·75	34·20	26·84	1·52	—	0·21	0·0	6·74	**N 50 V**	100–0	0912		
		5	—	6·73	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	6·73	34·20	26·84	1·54	—	0·21	0·0	—	,,	100–50			
		20	—	6·73	34·20	26·84	1·58	—	0·21	0·0	6·58	,,	250–100			
		30	—	6·73	34·20	26·84	1·58	—	0·21	0·0	—	,,	500–250			
		40	—	6·73	34·20	26·84	1·58	—	0·20	0·0	6·54	,,	750–500			
		50	—	6·73	34·20	26·84	1·56	—	0·21	0·0	—	,,	1000–750	—	1040	
		60	—	6·73	34·20	26·84	1·56	—	0·21	0·0	6·50	**NHP**	50–0	1041	1046	
		80	—	5·21	34·26	27·09	1·77	—	0·36	8·9	—	**CWS**	0			
		100	—	5·04	34·23	27·09	1·86	—	0·34	11·1	6·56	,,	5			
		150	—	4·94	34·23	27·10	1·84	—	0·00	10·2	6·50	,,	10			
		200	—	4·88	34·25	27·11	1·90	—	0·00	10·7	6·48	,,	20			
		300	—	4·68	34·23	27·13	1·90	—	0·00	11·4	6·65	,,	50			
		400	—	4·52	34·23	27·14	1·94	—	0·00	12·2	6·49	,,	100			
		600^1	605	3·80	34·18	27·18	2·38	—	—	16·5	6·28	**N 70 B**	146–0	1053	1113	KT
		790^1	—	3·70	34·27	27·26	2·89	—	—	28·6	5·01	**N 100 B**				
		990^1	997	3·27	34·37	27·38	3·04	—	—	41·9	4·42					
		1490^1	—	2·52	34·56	27·60	3·23	—	—	57·3	3·80					
		1990^1	1970	2·22	34·69	27·72	3·10	—	—	65·5	3·87					
1320	29	0	—	7·75	34·10	26·62	1·27	—	0·22	0·0	6·45	**N 50 V**	100–0	**2009**		
		5	—	7·75	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	7·75	34·11	26·63	1·39	—	0·21	0·0	—	,,	100–50			
		20	—	7·75	34·11	26·63	1·33	—	0·22	0·0	6·45	,,	250–100			
		30	—	7·75	34·11	26·63	1·37	—	0·21	0·0	—	,,	500–250			
		40	—	7·75	34·11	26·63	1·37	—	0·22	0·0	6·43	,,	750–500			
		50	—	7·75	34·11	26·63	1·39	—	0·21	0·0	—	,,	1000–750	—	**2130**	
		60	—	7·60	34·11	26·66	1·41	—	0·23	0·0	6·38	**NHP**	50–0	**2131**	**2135**	
		80	—	5·70	34·16	26·95	1·71	—	0·55	6·8	—	**CWS**	0			
		100	—	5·31	34·21	27·03	1·77	—	0·00	7·2	6·34	,,	5			
		145	—	5·06	34·22	27·06	1·84	—	0·00	9·2	6·41	,,	10			
		195	—	5·00	34·22	27·07	1·84	—	0·00	11·1	6·41	,,	20			
		290	—	4·86	34·25	27·12	1·84	—	0·00	12·3	6·38	,,	50			
		390	—	4·75	34·23	27·12	1·82	—	0·00	13·5	6·43	,,	100			
		580^1	578	4·37	34·22	27·14	2·17	—	—	14·0	6·13	**N 70 B**	100–0	**2314**	**2334**	KT
		780^1	—	3·96	34·25	27·21	2·68	—	—	25·3	5·20	**N 100 B**				
		970^1	966	3·43	34·37	27·37	3·16	—	—	36·7	4·49	**N 70 B**	340–160	**2314**	**2344**	DGP
		1450^1	—	2·64	34·57	27·60	3·16	—	—	54·5	3·46	**N 100 B**				
		1940^1	1950	2·22	34·66	27·70	3·16	—	—	74·4	3·38					
		2450^2	2458	1·92	34·70	27·76	3·16	—	—	76·6	3·40					
		2940^2	2934	1·77	34·75	27·82	3·12	—	—	84·5	3·95					
		3430^2	—	1·48	34·75	27·84	2·95	—	—	73·4	4·25					
		3910^2	3907	1·07	34·75	27·87	2·95	—	—	84·0	4·31					
1321	1	0	—	9·60	32·79	25·32	—	—	—	—	—	**BNR**	66	0753	0755	+5 hours
1322	6	0	—	8·05	33·77	26·32	—	—	—	—	—	**N 100 B**	130–0	1010	1030	KT. +4 hours
												N 50 V	100–0	1040	1046	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1323	52° 37′ S, 57° 19·2′ W	1934 27 iii	2000	537*	W	9	W	2	bc	991·2	6·4	6·2	mod. SW swell
1324	54° 21·3′ S, 56° 42·2′ W	28 iii	0900	126*	NNW	10	NNW	2	bc	986·0	7·2	6·7	mod. WNW swell
1325	55° 56·4′ S, 56° 00·4′ W	28 iii	2000	4274*	Lt airs	0–1	—	1	cpr	983·1	4·9	4·4	mod. conf. swell
1326	57° 26·6′ S, 55° 18′ W	29 iii	0900	3722*	NNW	8	NNW	2	b	984·3	3·3	3·0	mod. conf. WNW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.^{3}							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1323	13	0	—	6·85	34·03	26·70	1·43	—	0·32	<5·0	6·48	**N 50 V**	100–0	**2009**		
		5	—	6·85	—	—	—	—	—	<5·0	—	**N 70 V**	50–0			
		10	—	6·85	34·03	26·70	1·44	—	0·31	<5·0	—	,,	100–50			
		20	—	6·59	34·07	26·77	1·54	—	0·33	<5·0	6·44	,,	250–100			
		30	—	6·46	34·09	26·79	1·60	—	0·26	<5·0	—	,,	500–250			
		40	—	6·36	34·11	26·83	1·62	—	0·24	<5·0	6·59	**NHP**	50–0	—	**2053**	
		50	—	6·31	34·13	26·84	1·62	—	0·26	<5·0	—	**CWS**	0			
		60	—	6·25	34·13	26·85	1·60	—	0·26	<5·0	6·57	,,	5			
		80	—	6·11	34·13	26·87	1·69	—	0·24	<5·0	—	,,	10			
		100	—	5·59	34·13	26·93	1·75	—	0·00	10·2	6·26	,,	20			
		150	—	5·11	34·14	27·01	2·09	—	0·00	12·4	6·18	,,	50			
		200	—	4·99	34·18	27·05	2·17	—	0·00	13·2	6·20	,,	100			
		300	—	4·53	34·20	27·11	2·26	—	0·00	13·0	6·23	**N 70 B**	155–0	**2139**	**2159**	
		400	—	4·29	34·22	27·15	2·34	—	0·00	6·6	6·19	**N 100 B**				
		500	—	4·20	34·21	27·16	2·41	—	—	8·3	6·16					
1324	13	0	—	6·05	34·14	26·89	1·37	—	0·21	<5·0	6·60	**N 50 V**	100–0	0908		
		5	—	6·05	—	—	—	—	—	—	—	**NHP**	50–0	—	0919	
		10	—	6·05	34·14	26·89	1·39	—	0·21	<5·0	—	**CWS**	0			
		20	—	6·05	34·14	26·89	1·39	—	0·21	<5·0	6·59	,,	5			
		30	—	6·05	34·14	26·89	1·35	—	0·22	<5·0	—	,,	10			
		40	—	6·03	34·14	26·90	1·41	—	0·22	<5·0	6·54	,,	20			
		50	—	5·94	34·15	26·92	1·43	—	0·26	<5·0	—	,,	50			
		60	—	5·88	34·15	26·93	1·44	—	0·27	<5·0	6·49	,,	100			
		80	—	5·72	34·15	26·95	1·46	—	0·29	<5·0	—	**N 70 B**	99–0	0959	1019	KT
		100	—	5·72	34·15	26·95	1·43	—	0·31	7·8	6·31	**N 100 B**				
1325	14	0	—	6·02	34·14	26·90	1·48	—	0·21	<5·0	6·58	**N 50 V**	100–0	**2012**		
		5	—	6·02	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	6·02	34·14	26·90	1·50	—	0·21	<5·0	—	,,	100–50			
		20	—	5·98	34·14	26·90	1·52	—	0·19	12·9	6·61	,,	250–100			
		30	—	5·96	34·14	26·91	1·52	—	0·20	12·2	—	,,	500–250			
		40	—	5·96	34·14	26·91	1·52	—	0·20	<5·0	6·58	,,	750–500			
		50	—	5·95	34·14	26·91	1·52	—	0·21	<5·0	—	,,	1000–750			
		60	—	5·81	34·15	26·93	1·54	—	0·23	<5·0	6·44	**NHP**	50–0	—	**2213**	
		80	—	5·61	34·20	26·99	1·58	—	0·25	<5·0	—	**CWS**	0			
		95	—	5·33	34·20	27·02	1·60	—	0·22	<5·0	6·39	,,	5			
		145	—	4·66	34·22	27·11	1·69	—	0·00	15·1	6·39	,,	10			
		190	—	4·51	34·22	27·13	1·69	—	0·00	12·3	6·38	,,	20			
		285	—	4·26	34·22	27·15	1·81	—	0·00	14·8	6·32	,,	50			
		385	—	3·95	34·22	27·19	2·13	—	0·00	17·1	6·16	,,	100			
		570^1	575	3·42	34·22	27·24	2·43	—	—	27·3	5·61	**N 70 B**	148–0	**2320**	**2340**	KT
		760^1	764	3·28	34·29	27·31	2·47	—	—	29·9	5·20	**N 100 B**				
		960^1	953	3·11	34·34	27·38	2·83	—	—	40·7	4·66	**N 70 B**	540–170	**2320**	**2350**	DGP
		1430^1	1440	2·58	34·52	27·56	3·02	—	—	52·7	3·79	**N 100 B**				
		1870^2	1910	2·30	34·63	27·67	3·08	—	—	70·6	3·70					
		2340^2	2342	2·04	34·72	27·77	2·98	—	—	74·8	3·73					
		2810^2	—	1·72	34·74	27·81	2·98	—	—	84·3	4·02					
		3280^2	3262	1·30	34·73	27·83	2·98	—	—	89·9	4·21					
		3750^2	3748	0·78	34·71	27·86	2·98	—	—	97·3	4·36					
1326	14	0	—	2·42	33·86	27·04	2·09	—	0·34	14·4	7·15	**N 50 V**	100–0	0907		
		5	—	2·42	—	—	—	—	—	—	—	**NHP**	50–0	—	0918	
		10	—	2·31	33·86	27·05	2·09	—	0·34	15·1	—	**CWS**	0			
		20	—	1·61	33·86	27·10	2·11	—	0·25	15·6	7·20	,,	5			
		30	—	1·60	33·86	27·10	2·13	—	0·27	15·5	—	,,	10			
		40	—	1·58	33·87	27·12	2·17	—	0·26	17·8	7·18	,,	20			
		50	—	1·38	33·92	27·18	2·17	—	0·22	21·0	—	,,	50			
		60	—	1·20	33·93	27·19	2·17	—	0·22	26·9	7·15	,,	100			
		80	—	0·90	33·96	27·24	2·24	—	0·21	30·3	—	**N 70 B**	106–0	1102	1122	KT
		100	—	0·34	34·00	27·30	2·32	—	0·21	32·5	6·87	**N 100 B**				
		150	—	0·67	34·22	27·45	2·66	—	0·24	41·9	5·51	**N 70 B**	400–200	1102	1133	DGP
		195	—	1·63	34·39	27·54	3·14	—	0·00	54·8	4·46	**N 100 B**				
		290	—	1·94	34·51	27·60	3·02	—	0·00	60·5	4·01					
		390	—	1·97	34·58	27·66	3·06	—	0·00	68·1	3·92					
		580	—	1·97	34·66	27·72	3·06	—	—	74·9	3·91					
		780^1	788	1·99	34·72	27·77	2·98	—	—	81·9	3·80					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1326 *cont.*	57° 26·6′ S, 55° 18′ W	1934 29 iii											
1327	58° 48·5′ S, 55° 10·3′ W	29–30 iii	2000	4009*	E × N	9	E	2	omw	984·5	1·9	1·8	low conf. WSW swell
1328	60° 17′ S, 55° 03·2′ W	30 iii	0900	3422*	SE	5	SE	2	osp	987·4	0·0	−0·2	low SSW swell
1329	62° 06·4′ S, 49° 35′ W	31 iii	1300	3414*	E × S	13	E × S	3	c	989·7	−2·2	−3·1	mod. E × S swell
1330	61° 16′ S, 47° 21·9′ W	31 iii	2200	2599*	SE × E	12	ESE	2	osp	990·8	−2·2	−2·2	mod. ESE swell
1331	60° 11·5 S, 44° 23·9′ W	4 iv	1730	5402*	W × N	6	W × N	2	c	987·4	−0·6	−0·6	low W × N swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³				O₂ c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N₂	Nitrite N₂	Si				From	To	
1326	14	970[1]	962	1·77	34·73	27·80	2·93	—	—	84·5	3·95					
cont.		1450[1]	—	1·44	34·73	27·82	2·93	—	—	98·6	4·03					
		1940[1]	1938	1·03	34·72	27·84	2·98	—	—	108·2	4·26					
1327	15	0	—	2·51	33·95	27·11	2·15	—	0·24	23·3	7·16	**N 50 V**	100–0	**2009**		
		5	—	2·51	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	2·52	33·95	27·11	2·15	—	0·24	22·9	—	,,	100–50			
		20	—	2·52	33·95	27·11	2·13	—	0·25	23·0	7·17	,,	250–100			
		30	—	2·46	33·95	27·12	2·15	—	0·24	23·7	—	,,	500–250			
		40	—	2·44	33·96	27·13	2·17	—	0·25	25·1	7·18	,,	750–500			
		50	—	2·22	33·97	27·16	2·17	—	0·22	26·1	—	,,	1000–750			
		60	—	2·14	33·97	27·16	2·17	—	0·22	26·9	7·09	**NHP**	50–0	—	**2137**	
		80	—	0·78	34·07	27·34	2·43	—	0·22	29·9	—	**CWS**	0			
		100	—	0·35	34·18	27·45	2·83	—	0·34	38·9	6·25	,,	5			
		150	—	0·76	34·37	27·58	3·02	—	0·14	48·0	5·07	,,	10			
		200	—	1·41	34·48	27·62	3·02	—	0·00	54·2	4·33	,,	20			
		300	—	2·00	34·64	27·71	3·06	—	0·00	63·1	3·87	,,	50			
		400	—	2·06	34·69	27·73	3·06	—	0·00	72·6	3·88	,,	100			
		600[1]	604	1·90	34·73	27·79	2·98	—	—	78·2	3·86	**N 70 B**	144–0	**2330**	**2350**	KT
		790[1]	793	1·78	34·75	27·82	2·74	—	—	84·1	3·90	**N 100 B**				
		990[1]	982	1·56	34·75	27·83	2·26	—	—	92·3	4·01	**N 70 B**	500–200	**2330**	**0000**	DGP
		1480[2]	1491	1·18	34·75	27·86	2·83	—	—	98·3	4·22	**N 100 B**				
		1970[2]	1971	0·78	34·74	27·88	2·98	—	—	102·7	4·43					
		2470[2]	—	0·48	34·72	27·87	2·83	—	—	110·6	4·46					
		2960[2]	2958	0·17	34·70	27·88	2·98	—	—	114·6	4·71					
		3470[1]	3495	−0·06	34·69	27·87	2·98	—	—	116·1	4·93					
1328	15	0	—	0·95	33·94	27·22	2·22	—	0·23	25·0	7·32	**N 50 V**	100–0	0909		
		5	—	0·95	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·94	33·94	27·22	2·22	—	0·21	25·3	—	,,	100–50			
		20	—	0·93	33·94	27·22	2·22	—	0·20	27·0	7·35	,,	250–100			
		30	—	0·80	33·95	27·24	2·22	—	0·21	28·9	—	,,	500–250			
		40	—	0·60	34·09	27·36	2·22	—	0·22	39·5	7·15	,,	750–500			
		50	—	0·45	34·13	27·40	2·34	—	0·25	46·2	—	,,	1000–750			
		60	—	0·51	34·22	27·46	2·34	—	0·23	49·6	7·14	**NHP**	50–0	—	1122	
		80	—	0·40	34·24	27·50	2·41	—	0·26	53·6	—	**CWS**	0			
		100	—	0·27	34·28	27·54	2·53	—	0·24	58·7	6·65	,,	5			
		150	—	0·18	34·37	27·61	2·64	—	0·24	64·9	6·43	,,	10			
		195	—	0·20	34·43	27·66	2·64	—	0·22	70·4	6·06	,,	20			
		295	—	0·35	34·48	27·69	2·85	—	0·21	75·1	5·41	,,	50			
		390	—	0·22	34·45	27·67	2·85	—	0·21	78·3	5·81	,,	100			
		590[1]	581	0·28	34·58	27·77	2·85	—	0·18	81·3	5·03	**N 70 B**	161–0	1146	1206	KT
		780[1]	790	0·46	34·67	27·83	2·97	—	0·13	88·4	4·85	**N 100 B**				
		990[2]	999	1·03	34·75	27·87	2·97	—	—	96·9	4·23	**N 70 B**	540–170	1146	1216	DGP
		1490[2]	1476	0·55	34·73	27·88	2·76	—	—	108·1	4·41	**N 100 B**				
		1980[2]	—	0·30	34·72	27·88	2·91	—	—	114·5	4·55					
		2480[2]	2483	0·00	34·71	27·90	3·10	—	—	116·9	4·81					
		2980[2]	2999	−0·13	34·69	27·88	3·14	—	—	118·1	4·95					
1329	16	0	—	−1·64	33·68	27·12	—	—	—	—	—	**N 50 V**	100–0	1303		
												NHP	50–0	—	1315	
												N 70 B	146–0	1325	1345	KT
												N 100 B				
1330	17	0	—	−0·60	33·95	27·31	—	—	—	—	—	**N 50 V**	100–0	**2206**		
												NHP	50–0	—	**2219**	
												N 70 B	153–0	**2234**	**2254**	KT
												N 100 B				
												N 70 B	520–130	**2234**	**2304**	DGP
												N 100 B				
1331	20	0	—	−0·60	33·40	26·87	1·50	—	0·21	50·9	7·85	**N 50 V**	100–0	**1749**		
		10	—	−0·62	33·40	26·87	1·56	—	0·21	52·2	—	**N 70 V**	50–0			
		20	—	−0·60	33·47	26·92	1·54	—	0·21	52·3	7·77	,,	100–50			
		30	—	−0·56	33·68	27·09	1·60	—	0·21	52·6	—	,,	250–100			
		40	—	−0·63	33·82	27·21	1·71	—	0·24	52·5	7·43	,,	500–250			
		50	—	−0·73	34·00	27·35	1·92	—	0·30	57·3	—	,,	750–500			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1331 *cont.*	60° 11·5′ S, 44° 23·9′ W	1934 4 iv											
1332	58° 39·1′ S, 44° 24·8′ W	5 iv	0915	2963*	NW	7	NW	2	c	977·0	1·9	1·7	mod. NW swell
1333	57° 35·2′ S, 44° 20·8′ W	5 iv	2000	2890*	SSW	20	SSW	4	oe	989·0	1·2	0·8	mod. NW swell
1334	55° 54·3′ S, 44° 14·4′ W	6 iv	0900	3537*	SW × S	14	SW × S	3	c	1004·5	1·7	1·1	mod. SW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS					Mg.—atom m.³					BIOLOGICAL OBSERVATIONS		TIME		Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
1331 *cont.*	20	60	—	−0·90	34·11	27·45	2·13	—	0·38	59·0	6·92	**N 70 V**	1000–750			
		80	—	−1·20	34·22	27·54	2·43	—	0·39	63·9	—	**NHP**	50–0	—	**1909**	
		100	—	−1·11	34·33	27·63	2·51	—	0·27	68·0	6·41	**N 70 B**	122–0	**2130**	**2150**	KT
		150	—	−0·56	34·46	27·72	2·51	—	0·00	69·8	5·65	**N 100 B**				
		200	—	0·14	34·58	27·78	2·51	—	0·00	74·8	5·08	**N 70 B**	470–210	**2130**	**2200**	DGP
		300	—	0·25	34·63	27·82	2·57	—	0·00	84·7	4·97	**N 100 B**				
		400	—	0·42	34·66	27·83	2·57	—	0·00	89·4	4·87					
		600	—	0·42	34·68	27·85	2·57	—	0·00	92·4	4·78					
		800^1	788	0·33	34·68	27·85	2·68	—	0·00	98·2	4·63					
		990^1	979	0·31	34·70	27·87	2·76	—	—	102·8	4·59					
		1490^1	1496	0·11	34·69	27·86	2·85	—	—	104·7	4·71					
		1990^1	1991	−0·02	34·69	27·87	2·85	—	—	109·6	4·81					
		2490^1	2509	−0·13	34·69	27·88	2·79	—	—	113·6	4·95					
		2990^2	3016?	−0·21	34·68	27·88	2·70	—	—	111·6	5·16					
		3490^2	3492	−0·29	34·68	27·89	2·79	—	—	116·4	5·27					
		3990^2	—	−0·35	34·67	27·88	2·85	—	—	119·0	4·95					
		4490^2	4474	−0·32	34·66	27·87	2·79	—	—	110·1	5·31					
		4980^2	4980	−0·32	34·66	27·87	2·79	—	—	108·6	5·24					
1332	21	0	—	1·44	33·93	27·17	2·09	—	0·26	27·4	7·27	**N 50 V**	100–0	0921		
		10	—	1·43	33·93	27·17	2·09	—	0·26	27·5	—	**NHP**	50–0	—	0930	
		20	—	1·43	33·93	27·17	2·09	—	0·26	28·4	7·26	**N 70 B**	160–0	1123	1143	KT
		30	—	1·42	33·93	27·17	2·15	—	0·29	29·1	—	**N 100 B**				
		40	—	1·42	33·93	27·17	2·15	—	0·29	32·2	7·28	**N 70 B**	520–200	1123	1153	Depths estimated. **N 100 B** net may not have fished properly
		50	—	1·41	33·93	27·18	2·15	—	0·29	32·3	—	**N 100 B**				
		60	—	1·30	33·94	27·19	2·24	—	0·28	34·1	7·29					
		80	—	1·19	33·95	27·21	2·26	—	0·34	35·1						
		100	—	0·58	34·11	27·38	2·68	—	0·49	40·5	6·31					
		150	—	0·82	34·33	27·53	2·87	—	0·14	50·6	5·13					
		200	—	1·43	34·45	27·59	3·02	—	0·00	55·9	4·41					
		300	—	1·75	34·60	27·69	3·06	—	0·00	61·8	4·04					
		400	—	1·97	34·68	27·74	3·02	—	0·00	70·4	3·91					
		600^1	610	1·68	34·70	27·78	3·02	—	—	73·9	4·06					
		800^2	809	1·64	34·71	27·80	2·91	—	—	77·5	4·05					
		1000^2	1010	1·32	34·72	27·82	3·00	—	—	84·5	4·26					
		1500^2	1501	0·83	34·70	27·84	3·02	—	—	89·1	4·50					
		2000^2	2005	0·50	34·70	27·86	3·12	—	—	92·8	4·59					
		2500^2	2484	0·25	34·69	27·86	3·12	—	—	99·6	4·72					
1333	21	0	—	1·81	33·88	27·12	2·24	—	0·28	21·5	7·28	**N 50 V**	100–0	**2013**		
		10	—	1·80	33·88	27·12	2·24	—	0·29	21·2	—	**N 70 V**	50–0			
		20	—	1·80	33·88	27·12	2·24	—	0·29	21·0	7·29	,,	100–50			
		30	—	1·71	33·88	27·12	2·28	—	0·29	23·2	—	,,	250–100			
		40	—	1·13	33·92	27·19	2·30	—	0·29	32·1	7·34	,,	500–250			
		50	—	1·12	33·92	27·19	2·36	—	0·30	35·8	—	,,	750–500			
		60	—	0·97	33·95	27·22	2·36	—	0·34	37·8	7·15	,,	1000–750			
		80	—	0·70	34·12	27·38	2·79	—	0·47	41·4	—	**NHP**	50–0	—	**2139**	
		100	—	0·81	34·27	27·49	3·02	—	0·29	46·4	5·34	**N 70 B**	100–0	**2212**	**2232**	KT
		150	—	1·43	34·44	27·59	3·16	—	0·00	50·5	4·45	**N 100 B**				
		200	—	1·23	34·47	27·63	3·19	—	0·00	56·3	4·52	**N 100 B**	360–220	**2212**	**2242**	DGP
		300	—	1·50	34·59	27·71	3·10	—	0·00	63·7	4·23					
		400	—	1·86	34·68	27·75	3·10	—	0·00	64·8	3·97					
		600^1	605	1·74	34·72	27·79	3·04	—	—	77·9	4·04					
		800^2	806	1·35	34·70	27·81	2·95	—	—	80·7	4·24					
		1000^2	1006	1·19	34·70	27·82	3·19	—	—	88·7	4·32					
		1490^2	1494	0·64	34·69	27·83	3·02	—	—	95·2	4·63					
		1990^2	1989	0·30	34·69	27·85	2·76	—	—	98·8	4·75					
		2490^2	2487	0·15	34·69	27·86	2·83	—	—	106·9	4·82					
1334	22	0	—	2·64	33·88	27·05	1·69	—	0·26	11·5	7·18	**N 50 V**	100–0	0929		
		10	—	2·62	33·88	27·05	1·69	—	0·26	12·4	—	**NHP**	50–0	—	0942	
		20	—	2·62	33·88	27·05	1·71	—	0·25	13·2	7·16	**N 70 B**	126–0	1100	1120	KT
		30	—	2·62	33·88	27·05	1·73	—	0·26	13·2	—	**N 100 B**				
		40	—	2·61	33·88	27·05	1·75	—	0·26	14·6	7·16	**N 70 B**	460–230	1100	1130	DGP. **N 100 B** probably did not fish properly
		50	—	2·59	33·88	27·06	1·77	—	0·25	14·4	—	**N 100 B**				
		60	—	2·58	33·88	27·06	1·79	—	0·25	14·4	7·15					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1334 *cont.*	55° 54·3′ S, 44° 14·4′ W	1934 6 iv											
1335	54° 37·8′ S, 44° 12·6′ W	6–7 iv	2100	5088*	N	16	N	4	bc	1004·1	3·0	2·9	mod. conf. W swell
			0000	—	N	25	N	4	c	1019·6	3·8	3·2	mod. conf. W swell
1336	53° 38·8′ S, 44° 11·2′ W	7 iv	0900	2200*	NW	21	NW	4	om	988·0	4·4	4·4	mod. conf. NW swell
1337	52° 25·1′ S, 44° 09·6′ W	7 iv	2000	3440*	W × N	10	W × N	3	ce	985·4	4·2	3·9	mod. conf. W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S°/₀₀	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
1334 *cont.*	22	80	—	1·73	33·94	27·16	1·88	—	0·24	19·2						
		100	—	0·58	33·96	27·26	2·20	—	0·21	20·8	7·30					
		150	—	0·37	34·10	27·38	2·36	—	0·18	27·4	6·58					
		200	—	1·05	34·22	27·43	2·60	—	0·00	37·6	5·59					
		300	—	2·17	34·44	27·54	3·02	—	0·00	48·9	4·25					
		400	—	2·25	34·53	27·60	2·89	—	0·00	53·9	3·99					
		600^{1}	599	2·18	34·63	27·68	2·89	—	—	57·4	3·80					
		800^{2}	805	1·98	34·65	27·71	2·91	—	—	60·0	3·83					
		1000^{2}	998	1·98	34·73	27·78	2·89	—	—	66·5	3·85					
		1500^{2}	1489	1·59	34·74	27·82	2·70	—	—	72·1	4·10					
		2000^{2}	1991	1·16	34·74	27·85	2·85	—	—	80·3	4·32					
		2500^{2}	2501	0·73	34·74	27·88	2·85	—	—	97·5	4·53					
1335	22	0	—	3·17	33·95	27·05	1·58	—	0·26	12·3	7·11	**N 50 V**	100–0	**2116**	—	+3 hours
		5	—	3·16	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	3·15	33·95	27·06	1·58	—	0·26	13·0	—	,,	100–50			
		20	—	3·15	33·95	27·06	1·56	—	0·26	13·2	7·11	,,	250–100			
		30	—	3·15	33·95	27·06	1·62	—	0·26	13·5	—	,,	500–250			
		40	—	3·13	33·95	27·06	1·52	—	0·26	14·2	7·12	,,	750–500			
		50	—	3·13	33·95	27·06	1·60	—	0·26	14·5	—	,,	1000–750			
		60	—	3·13	33·95	27·06	1·63	—	0·26	16·4	7·06	**NHP**	50–0	—	**2237**	
		80	—	3·05	33·95	27·07	1·65	—	0·26	16·1	—	**CWS**	0			
		100	—	2·52	34·05	27·19	1·79	—	0·24	20·0	6·66	,,	5			
		150	—	2·00	34·11	27·28	1·86	—	0·00	22·7	6·34	,,	10			
		195	—	1·39	34·11	27·33	2·11	—	0·00	26·5	6·33	,,	20			
		295	—	1·84	34·22	27·37	2·40	—	0·00	40·3	5·41	,,	50			
		390	—	2·17	34·34	27·46	2·41	—	0·00	45·0	5·58	,,	100			
		590^{1}	590	2·16	34·50	27·58	2·60	—	—	53·7	4·03	**N 100 B**	137–0	**0120**	**0140**	KT
		790^{1}	787	2·16	34·58	27·65	2·60	—	—	61·6	3·82	**N 70 B** **N 100 B**	520–190	**0120**	**0150**	DGP. **N 100 B** probably did not fish properly
		990^{1}	995	2·09	34·67	27·72	2·60	—	—	66·4	3·82					
		1450^{2}	—	1·78	34·72	27·79	2·53	—	—	72·1	4·00					
		1930^{2}	1930	1·39	34·73	27·82	2·53	—	—	80·2	4·21					
		2460^{3}	2459	0·97	34·73	27·85	2·60	—	—	83·3	4·31					
		2950^{3}	—	0·62	34·71	27·87	2·55	—	—	91·7	4·52					
		3450^{3}	3447	0·48	34·70	27·86	2·55	—	—	94·9	4·66					
		3940^{3}	3936	0·45	34·68	27·85	2·55	—	—	94·5	4·63					
		4430^{3}	4436	0·48?	34·68	27·84?	2·62	—	—	99·9	4·55					
1336	23	0	—	3·12	33·94	27·05	2·13	—	0·27	11·9	7·11	**N 50 V**	100–0	0910		
		10	—	3·10	33·94	27·05	2·03	—	0·27	11·5	—	**NHP**	50–0	—	0921	
		20	—	3·09	33·94	27·05	2·07	—	0·26	10·8	7·15	**N 70 B** **N 100 B**	128–0	1038	1058	KT. **N 100 B** not fishing properly
		30	—	3·09	33·94	27·05	2·11	—	0·26	12·2	—					
		40	—	3·05	33·94	27·06	2·13	—	0·26	12·7	7·12	**N 70 B** **N 100 B**	460–220	1038	1109	DGP. **N 100 B** probably did not fish properly
		50	—	3·04	33·94	27·06	2·07	—	0·26	12·8	—					
		60	—	3·03	33·94	27·06	2·11	—	0·26	14·3	7·08					
		80	—	2·97	33·94	27·06	2·22	—	0·27	14·5						
		100	—	2·01	33·94	27·14	2·28	—	0·31	16·5	7·14					
		150	—	0·96	34·07	27·32	2·64	—	0·00	25·0	6·65					
		200	—	1·50	34·17	27·37	2·98	—	0·00	34·2	5·67					
		300	—	1·86	34·33	27·46	3·17	—	0·00	41·9	4·78					
		400	—	2·09	34·43	27·53	3·23	—	0·00	53·9	4·03					
		600^{1}	606	2·05	34·56	27·64	3·35	—	—	61·6	3·92					
		800^{1}	798	2·02	34·62	27·70	3·23	—	—	68·9	3·83					
		1000^{1}	991	1·92	34·69	27·74	3·19	—	—	73·1	3·90					
		1500^{1}	1492	1·51	34·73	27·82	3·14	—	—	82·2	4·15					
		2000^{1}	2001	1·06	34·73	27·85	3·14	—	—	87·3	4·32					
1337	23	0	—	3·60	33·89	26·96	2·15	—	0·28	6·2	7·14	**N 50 V**	100–0	**2008**		
		10	—	3·60	33·89	26·96	2·11	—	0·29	6·3	—	**N 70 V**	50–0			
		20	—	3·59	33·89	26·96	2·09	—	0·28	7·0	7·10	,,	100–50			
		30	—	3·54	33·89	26·97	2·03	—	0·29	7·3	—	,,	250–100			
		40	—	3·44	33·89	26·98	2·09	—	0·28	9·5	7·15	,,	500–250			
		50	—	3·39	33·89	26·98	2·17	—	0·29	10·2	—	,,	750–500			
		60	—	3·32	33·90	27·00	2·17	—	0·29	12·0	7·14	,,	1000–750			
		80	—	2·64	33·93	27·08	2·22	—	0·30	13·4	—	**NHP**	50–0	—	**2122**	
		100	—	1·07	33·97	27·24	2·78	—	0·35	17·7	7·14	**N 70 B** **N 100 B**	142–0	**2204**	**2224**	KT
		150	—	1·08	34·12	27·36	2·93	—	0·00	23·7	6·31					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1337 *cont.*	52° 25·1′ S, 44° 09·6′ W	1934 7 iv											
1338	50° 44·8′ S, 44° 07·6′ W	8 iv	0900	1595*	WSW	24	WSW	4	c	1001·1	5·6	5·0	mod. W × S swell
1339	51° 54·1′ S, 41° 21·9′ W	8 iv	2200	3509*	W	25	W	4	c	1002·2	5·0	4·5	mod. W swell
1340	52° 56·6′ S, 38° 55·7′ W	9 iv	0900	3742*	W × S	24	W	4	om	1001·9	3·1	3·0	mod. W swell
1341	3 miles S 60° E of Jason I, South Georgia	20 iv	1905	—	SE	14	SE	2	b	985·7	0·0	−0·2	low S swell
1342	53° 50·9′ S, 32° 50·3′ W	21 iv	0900	—	SW	26	SW	4	cspq	989·1	−0·2	−0·4	heavy SW swell
1343	53° 34′ S, 27° 26·2′ W	22 iv	0900	4704*	SSW	23	SSW	5	o	990·2	−0·3	−0·3	mod. SSW swell
1344	53° 46·3′ S, 24° 57·4′ W	22–23 iv	2000	4385*	SW × S	25	SW × S	4	c	986·2	1·4	1·0	heavy SW × S swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S °/₀₀	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1337 *cont.*	23	200	—	1·71	34·25	27·41	3·12	—	0·00	33·0	5·39	**N 70 B** **N 100 B**	420–220	**2204**	**2233**	DGP. **N 100 B** may not have fished properly
		300	—	2·12	34·40	27·50	3·12	—	0·00	37·7	4·50					
		400	—	2·16	34·49	27·57	3·31	—	0·00	44·9	4·17					
		600^1	595	2·15	34·61	27·68	3·36	—	—	51·7	3·88					
		800^1	817?	2·08	34·69	27·73	3·06	—	—	67·5	3·84					
		1000^2	1008	1·96	34·71	27·77	3·06	—	—	72·7	3·87					
		1500^2	1492	1·63	34·73	27·81	2·57	—	—	78·3	4·12					
		2000^2	2007	1·14	34·73	27·84	2·95?	—	—	87·9	4·36					
		2500^2	2493	0·62	34·72	27·87	2·70	—	—	93·0	4·59					
		3000^2	3003	0·39	34·70	27·87	3·14	—	—	104·2	4·71					
1338	24	0	—	5·95	33·98	26·78	1·58	—	0·29	<5·0	6·65	**N 50 V**	100–0	0909		
		10	—	5·95	33·98	26·78	1·52	—	0·28	<5·0	—	**NHP**	50–0	—	0915	
		20	—	5·95	33·98	26·78	1·41	—	0·29	<5·0	6·63	**N 70 B** **N 100 B**	100–0	1032	1052	KT
		30	—	5·95	33·98	26·78	1·44	—	0·29	<5·0	—					
		40	—	5·95	33·98	26·78	1·46	—	0·29	<5·0	6·61	**N 70 B** **N 100 B**	370–170	1032	1102	DGP
		50	—	5·94	33·98	26·78	1·48	—	0·29	<5·0	—					
		60	—	5·94	33·99	26·79	1·52	—	0·29	<5·0	6·60					
		80	—	5·78	33·99	26·81	1·62	—	0·30	<5·0						
		100	—	4·64	34·04	26·97	1·77	—	0·33	<5·0	6·57					
		150	—	3·21	34·13	27·19	2·19	—	0·00	16·4	6·49					
		200	—	2·66	34·14	27·26	2·28	—	0·00	26·6	6·47					
		295	—	2·04	34·08	27·26	2·38	—	0·00	25·2	6·37					
		395	—	1·49	34·23	27·42	2·70	—	0·00	31·4	5·37					
		590^1	593	2·50	34·37	27·45	3·16	—	—	45·0	4·31					
		790^1	781	2·32	34·50	27·56	3·16	—	—	55·2	3·91					
		980^1	978	2·22	34·60	27·65	3·25	—	—	61·0	3·78					
		1480^1	1500	1·99	34·70	27·76	3·10	—	—	65·1	3·86					
1339	24	0	—	3·60	33·90	26·97	—	—	—	—	—	**N 50 V**	100–0	**2208**		
												NHP	50–0	—	**2217**	
												N 70 B **N 100 B**	155–0	**2226**	**2246**	KT
1340	25	—	—	—	—	—	—	—	—	—	—	**N 50 V**	100–0	0906		
												NHP	50–0	—	0918	
												N 70 B **N 100 B**	95–0	0938	0958	KT
												N 70 B **N 100 B**	340–180	0938	1008	DGP. **N 100 B** may not have fished properly
1341	7	0	—	1·57	32·90	26·34	—	—	—	—	—	**N 50 V**	100–0	**1908**	**1915**	+2 hours 30 minutes
1342	7	0	—	0·95	33·78	27·10	—	—	—	—	—	**N 50 V**	100–0	0908		
												NHP	50–0	—	0924	Release gear of net failed
												N 70 B **N 100 B**	108–0	0934	0954	KT
1343	8	0	—	1·45	33·80	27·07	—	—	—	—	—	**N 50 V**	100–0	0907		
												NHP	50–0	—	0917	
												N 70 B **N 100 B**	133–0	0927	0947	KT
1344	9	0	—	2·62	33·90	27·06	1·44	—	0·28	<5·0	7·10	**N 50 V**	100–0	**2030**		
		10	—	2·62	33·90	27·06	1·37	—	0·27	<5·0	—	**N 70 V**	50–0			
		20	—	2·62	33·90	27·06	1·37	—	0·27	<5·0	7·10	,,	100–50			
		30	—	2·62	33·90	27·06	1·39	—	0·27	<5·0	—	,,	250–100			
		40	—	2·62	33·90	27·06	1·41	—	0·27	<5·0	7·10	,,	500–250			
		50	—	2·62	33·90	27·06	1·46	—	0·26	<5·0	—	,,	750–500			
		60	—	2·62	33·90	27·06	1·48	—	0·28	<5·0	7·07	,,	1000–750			
		80	—	2·33	33·94	27·12	1·58	—	0·27	11·2	—	**NHP**	50–0	—	**2154**	
		100	—	1·15	34·05	27·29	1·88	—	0·00	21·2	6·49	**N 70 B** **N 100 B**	110–0	**2331**	**2351**	KT
		150	—	1·31	34·17	27·38	2·20	—	0·00	31·7	5·95					
		200	—	1·64	34·26	27·43	2·60	—	0·00	40·0	5·14	**N 70 B** **N 100 B**	440–0	**2331**	**0016**	DGP. Nets did not close. **N 100 B** fished on surface for 10 min.
		300	—	1·89	34·42	27·53	2·57	—	0·00	50·3	4·42					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1344 *cont.*	53° 46·3′ S, 24° 57·4′ W	1934 22–23 iv											
1345	54° 21·6′ S, 23° 24·1′ W	23 iv	0900	4451*	SW × S	25	SW × S	5	csp	978·4	0·6	0·6	heavy SW × S swell
1346	55° 24·9′ S, 22° 57·1′ W	23 iv	2000	3833*	SW × W	30	SW × W	5	o	984·1	− 1·5	− 1·5	heavy SW × W swell
1347	56° 28·7′ S, 22° 38·7′ W	24 iv	0900	4274*	SW × W	31	SW × W	5	crsp	979·5	0·0	0·0	heavy SW swe

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	Mg.—atom m.³				O₂ c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N₂	Nitrite N₂	Si				From	To	
1344 *cont.*	9	400	—	2·05	34·53	27·62	2·62	—	0·00	62·9	4·04					
		600^1	595	2·17	34·65	27·70	2·64	—	—	68·4	3·83					
		790^1	815?	2·13	34·70	27·75	2·64	—	—	70·4	4·01					
		990^1	992	2·00	34·72	27·77	2·59	—	—	79·2	4·14					
		1490^1	1487	1·54	34·71	27·80	2·01	—	—	81·3	4·34					
		1990^2	—	0·85	34·70	27·84	2·60	—	—	93·8	4·45					
		2490^2	2487	0·47	34·69	27·84	2·62	—	—	98·0	4·61					
		2990^2	3003	0·26	34·69	27·86	2·76	—	—	106·7	4·75					
		3490^2	3524?	0·05	34·68	27·87	2·81	—	—	117·1	4·93					
		3990^2	3989	−0·15	34·67	27·87	2·83	—	—	117·5	5·04					
1345	9	0	—	1·86	33·85	27·08	1·48	—	0·29	13·8	7·26	**N 50 V**	100–0	0911		
		10	—	1·83	33·85	27·09	1·48	—	0·26	13·9	—	**NHP**	50–0	—	0930	
		20	—	1·83	33·85	27·09	1·44	—	0·26	15·1	7·26	**N 70 B**	182–0	1034	1054	KT
		30	—	1·83	33·85	27·09	1·48	—	0·26	15·0	—	**N 100 B**				
		40	—	1·83	33·85	27·09	1·56	—	0·26	16·5	7·27					
		50	—	1·81	33·85	27·09	1·52	—	0·26	17·7						
		60	—	1·81	33·85	27·09	1·54	—	0·26	17·6	7·26					
		80	—	1·88	33·88	27·11	1·58	—	0·27	17·4						
		100	—	1·82	33·89	27·12	1·60	—	0·26	18·5	7·18					
		150	—	0·16	34·11	27·40	2·19	—	0·10	42·4	6·50					
		200	—	−0·19	34·30	27·57	2·57	—	0·00	52·2	6·02					
		300	—	0·52	34·49	27·68	2·49	—	0·00	63·4	5·10					
		400	—	0·85	34·58	27·74	2·59	—	0·00	68·5	4·76					
		600^1	608	1·09	34·67	27·80	2·89	—	—	79·3	4·36					
		800^1	797	1·01	34·70	27·83	2·89	—	—	84·3	4·39					
		990^1	1009?	0·99	34·72	27·84	2·87	—	—	88·9	4·35					
		1490^1	1488	0·65	34·70	27·85	2·87	—	—	98·6	4·55					
		1990^1	1985	0·39	34·69	27·85	2·87	—	—	102·3	4·56					
1346	10	0	—	1·21	33·91	27·18	1·58	—	0·25	21·6	7·29	**N 50 V**	100–0	2014		
		10	—	1·21	33·91	27·18	1·62	—	0·24	20·8	—	**N 70 V**	50–0			
		20	—	1·21	33·91	27·18	1·69	—	0·25	20·7	7·30	,,	100–50			
		30	—	1·20	33·91	27·18	1·69	—	0·24	21·2	—	,,	250–100			
		40	—	1·20	33·91	27·18	1·67	—	0·24	21·5	7·31	,,	500–250			
		50	—	1·20	33·91	27·18	1·69	—	0·24	21·7	—	,,	750–500			
		60	—	1·20	33·91	27·18	1·71	—	0·24	21·5	7·26	,,	1000–750			
		80	—	1·18	33·91	27·18	1·73	—	0·24	22·8	—	**NHP**	50–0	—	2149	
		100	—	0·38	34·06	27·35	2·30	—	0·16	36·6	6·88	**N 70 B**	182–0	2257	2317	KT
		150	—	0·08	34·28	27·55	2·81	—	0·00	53·3	6·07	**N 100 B**				
		195	—	1·05	34·50	27·66	2·81	—	0·00	60·8	4·79	**N 70 B**	520–160?	2257	2333	DGP. Nets did not fish properly
		295	—	1·55	34·61	27·72	2·79	—	0·00	68·0	4·21	**N 100 B**				
		390	—	1·71	34·69	27·76	2·91	—	0·00	70·1	4·11					
		590^1	574	1·53	34·70	27·79	2·81	—	—	76·7	4·22					
		780^1	778	1·21	34·71	27·83	2·81	—	—	82·1	4·36					
		980^1	998	1·15	34·72	27·83	2·78	—	—	84·6	4·39					
		1470^2	1466	0·66	34·70	27·85	2·79	—	—	96·1	4·48					
		1960^2	1937	0·39	34·69	27·85	2·85	—	—	96·5	4·63					
		2450^2	2446	0·18	34·69	27·86	2·91	—	—	104·9	4·77					
		2940^2	2974	−0·01	34·69	27·87	2·91	—	—	108·5	5·05					
		3430^2	3447	−0·14	34·68	27·88	2·91	—	—	113·3	5·05					
1347	10	0	—	1·11	33·95	27·22	1·62	—	0·24	21·1	7·29	**N 50 V**	100–0	0912	—	+2 hours
		10	—	1·11	33·95	27·22	1·62	—	0·24	21·2	—	**NHP**	50–0	—	0925	
		20	—	1·11	33·95	27·22	1·65	—	0·24	21·6	7·32	**N 70 B**	159–0	1047	1107	KT
		30	—	1·11	33·95	27·22	1·71	—	0·25	22·7	—	**N 100 B**				
		40	—	1·11	33·95	27·22	1·69	—	0·24	23·5	7·28					
		50	—	1·11	33·95	27·22	1·69	—	0·23	23·5						
		60	—	1·11	33·95	27·22	1·69	—	0·24	24·0	7·27					
		80	—	1·11	33·95	27·22	1·69	—	0·24	25·6						
		100	—	0·38	34·09	27·37	2·22	—	0·16	39·9	6·85					
		150	—	−0·10	34·35	27·62	2·57	—	0·00	58·8	5·91					
		200	—	0·52	34·48	27·68	2·57	—	0·00	66·5	5·18					
		300	—	1·31	34·60	27·72	2·66	—	0·00	75·5	4·40					
		400	—	1·46	34·66	27·76	2·64	—	0·00	79·3	4·29					
		590^1	607	1·28	34·70	27·81	2·64	—	—	87·4	4·25					
		790^1	785	1·12	34·72	27·83	2·64	—	—	90·4	4·37					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1347 *cont.*	56° 28·7′ S, 22° 38·7′ W	1934 24 iv											
1348	57° 48·3′ S, 22° 18·2′ W	25 iv	0900	4629*	SW	19	SW	4	o	991·5	−4·7	−5·3	heavy SW swell
1349	60° 13·4′ S, 22° 11·9′ W	26 iv	0914	3522*	WNW	20	WNW	3	c	974·6	0·0	−0·8	mod. WNW swell
1350	61° 19·5′ S, 21° 39·1′ W	26 iv	1815	3967*	W × S	23	W × S	4	csp	973·2	−6·5	−7·0	mod. conf. W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	Mg.—atom m.³				O₂ c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N₂	Nitrite N₂	Si				From	To	
1347 *cont.*	10	990^1	990	0·93	34·71	27·85	2·60	—	—	98·5	4·36					
		1480^1	1477	0·57	34·70	27·86	2·64	—	—	98·4	4·47					
		1980^1	1993	0·30	34·69	27·85	2·76	—	—	107·2	4·56					
1348	11	0	—	0·72	33·87	27·18	1·54	—	0·24	21·4	7·43	**N 50 V**	100–0	0914		
		10	—	0·72	33·87	27·18	1·56	—	0·24	21·2	—	**N 70 V**	50–0			
		20	—	0·72	33·87	27·18	1·52	—	0·24	21·4	7·42	,,	100–50			
		30	—	0·72	33·87	27·18	1·71	—	0·24	22·2	—	,,	250–100			
		40	—	0·72	33·87	27·18	1·58	—	0·24	22·4	7·37	,,	500–250			
		50	—	0·72	33·87	27·18	1·41	—	0·24	24·0	—	,,	750–500			
		60	—	0·72	33·87	27·18	1·52	—	0·23	23·2	7·37	,,	1000–750			
		80	—	0·72	33·87	27·18	1·56	—	0·25	24·3	—	**NHP**	50–0	—	1040	
		100	—	0·64	33·92	27·23	1·62	—	0·24	27·5	7·26	**N 70 B**	141–0	1223	1243	KT. **N 70 B** torn
		150	—	−1·09	34·29	27·60	2·24	—	0·00	55·8	6·75	**N 100 B**				
		200	—	−0·33	34·41	27·67	2·41	—	0·00	59·2	5·83	**N 70 B**	540–300	1223	1253	DGP. **N 100 B** did not fish properly
		300	—	0·99	34·65	27·78	2·53	—	0·00	63·9	4·56	**N 100 B**				
		400	—	0·94	34·68	27·81	2·47	—	0·00	69·3	4·54					
		600^1	602	0·75	34·70	27·85	2·66	—	—	73·7	4·48					
		800^1	814	0·73	34·71	27·86	2·66	—	—	77·4	4·48					
		1000^1	981	0·57	34·70	27·86	2·68	—	—	81·0	4·52					
		1500^1	1500	0·28	34·69	27·85	2·68	—	—	92·8	4·63					
		2000^1	2008	0·11	34·69	27·86	2·68	—	—	96·7	4·74					
		2500^2	2545?	−0·06	34·68	27·87	2·68	—	—	102·7	4·91					
		3000^2	3007	−0·16	34·68	27·88	2·72	—	—	109·3	4·95					
		3500^2	3488	−0·25	34·68	27·88	2·72	—	—	90·2	5·17					
		4000^2	4028?	−0·40	34·67	27·88	2·72	—	—	90·7	5·22					
		4500^2	4495	−0·40	34·67	27·88	2·72	—	—	92·5	5·26					
1349	12	0	—	0·30	33·77	27·11	1·41	—	0·24	18·7	7·44	**N 50 V**	100–0	0923		
		10	—	0·30	33·77	27·11	1·44	—	0·25	19·5	—	**NHP**	50–0	—	0944	**NHP** may not have fished properly
		20	—	0·32	33·78	27·13	1·43	—	0·24	19·7	7·46					
		30	—	0·33	33·78	27·13	1·46	—	0·24	21·1	—	**N 70 B**	119–0	1035	1055	KT
		40	—	0·39	33·80	27·14	1·43	—	0·25	21·5	7·43	**N 100 B**				
		50	—	0·40	33·80	27·14	1·46	—	0·24	21·9						
		60	—	0·50	33·88	27·20	1·63	—	0·24	23·0	7·25					
		80	—	−0·18	34·07	27·39	2·22	—	0·22	40·2						
		100	—	−0·80	34·22	27·53	2·47	—	0·08	54·3	6·49					
		150	—	−0·39	34·39	27·66	2·45	—	0·00	59·8	5·86					
		200	—	0·43	34·50	27·70	2·45	—	0·00	69·6	5·09					
		300	—	0·96	34·63	27·77	2·51	—	0·00	72·5	4·60					
		400	—	1·12	34·68	27·80	2·55	—	0·00	77·4	4·50					
		600^1	605	0·98	34·70	27·83	2·55	—	—	80·0	4·58					
		800^1	821?	0·87	34·72	27·85	2·55	—	—	82·1	4·47					
		990^1	987	0·69	34·71	27·86	2·62	—	—	90·6	4·43					
		1490^1	1499	0·40	34·70	27·87	2·68	—	—	97·4	4·36					
		1990^1	1987	0·19	34·69	27·86	2·68	—	—	102·5	4·67					
1350	13	0	—	−1·70	34·08	27·45	1·75	—	0·18	51·1	7·76	**N 50 V**	100–0	1824		
		10	—	−1·70	34·08	27·45	1·75	—	0·18	52·7	—	**N 70 V**	50–0			
		20	—	−1·69	34·08	27·45	1·73	—	0·16	53·5	7·78	,,	100–50			
		30	—	−1·69	34·08	27·45	1·69	—	0·16	53·7	—	,,	250–100			
		40	—	−1·69	34·08	27·45	1·71	—	0·16	54·7	7·76	,,	500–250			
		50	—	−1·69	34·08	27·45	1·81	—	0·17	56·4	—	,,	750–500			
		60	—	−1·66	34·08	27·45	1·67	—	0·18	56·8	7·73	,,	1000–750			
		80	—	−1·45	34·40	27·70	2·28	—	0·12	62·3	—	**NHP**	50–0	—	1957	
		100	—	−1·40	34·47	27·76	2·28	—	0·10	65·7	6·28	**N 70 B**	124–0	2104	2124	KT
		150	—	−0·70	34·58	27·82	2·51	—	0·00	70·6	5·42	**N 100 B**				
		200	—	−0·14	34·61	27·83	2·51	—	0·00	84·2	4·82	**N 70 B**	530–270	2104	2134	DGP. **N 100 B** may not have fished properly
		300	—	0·34	34·68	27·85	2·51	—	0·00	90·2	4·33	**N 100 B**				
		400	—	0·44	34·69	27·85	2·51	—	0·00	97·3	4·29					
		600^1	594	0·34	34·70	27·87	2·79	—	—	101·4	4·35					
		800^1	800	0·30	34·70	27·87	2·79	—	—	105·2	4·48					
		1000^1	1013	0·21	34·69	27·86	2·79	—	—	113·9	4·44					
		1490^2	1459?	0·00	34·69	27·87	2·83	—	—	115·2	4·64					
		1990^2	1992	−0·16	34·68	27·88	2·83	—	—	118·4	4·86					
		2480^2	2472	−0·27	34·68	27·88	2·83	—	—	121·5	5·07					
		2980^2	2975	−0·37	34·67	27·88	2·83	—	—	121·1	5·17					
		3480^2	3502	−0·48	34·67	27·88	2·83	—	—	121·6	5·32					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1351	60° 18·6′ S, 14° 13·8′ W	1934 27 iv	2200	4391*	W × N	20	W × N	4	c	971·0	−3·9	−4·5	mod. W × N swell
1352	60° 04·5′ S, 08° 06·5′ W	28 iv	2200	5263*	N	16	N	4	c	964·4	−0·5	−0·5	mod. N swell
1353	59° 25·7′ S, 03° 30·1′ E	30 iv	2200	5241*	NNE	8	NE	3	bc	967·1	−0·6	−0·9	mod. conf. N and NW swells
1354	59° 06′ S, 10° 38·3′ E	1 v	2200	5375*	N	4	—	1	c	969·1	−1·7	−2·8	low N swell
1355	58° 43·3′ S, 16° 38·1′ E	2 v	2000	4223*	NNE	23	NNE	4	osp	974·4	0·0	−0·3	mod. NNE swell
1356	60° 12·8′ S, 19° 37·5′ E	3 v	2000	4971*	NNE	25	NE × N	4	c	955·1	−0·7	−1·2	heavy ENE swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	Mg.—atom m.³				O₂ c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N₂	Nitrite N₂	Si				From	To	
1351	14	0	—	−1·30	34·29	27·60	—	—	—	—	—	**N 50 V**	100–0	**2208**		
												NHP	50–0	—	**2218**	
												N 70 B **N 100 B**	132–0	**2224**	**2244**	KT
1352	15	0	—	−0·95	34·23	27·55	—	—	—	—	—	**N 50 V**	100–0	**2205**	—	GMT
												NHP	50–0	—	**2214**	
												N 70 B **N 100 B**	146–0	**2219**	**2239**	KT
1353	17	0	—	−0·80	34·16	27·49	—	—	—	—	—	**N 50 V**	100–0	**2203**	—	−1 hour
												NHP	50–0	—	**2212**	
												N 70 B **N 100 B**	153–0	**2218**	**2238**	KT
												N 100 H	0–5	**2218**	**2239**	
1354	18	0	—	−0·55	34·10	27·43	—	—	—	—	—	**N 50 V**	100–0	**2202**		
												NHP	50–0	—	**2211**	
												N 70 B **N 100 B**	106–0	**2216**	**2236**	KT
												N 100 H	0–5	**2218**	**2238**	
1355	19	0	—	−0·58	33·97	27·33	1·92	—	0·23	44·9	7·84	**N 50 V**	100–0	**2012**	—	−2 hours
		10	—	−0·58	33·97	27·33	2·07	—	0·21	47·3	—	**N 70 V**	50–0			
		20	—	−0·58	33·97	27·33	2·09	—	0·22	47·6	7·72	,,	100–50			
		30	—	−0·58	33·97	27·33	2·17	—	0·22	47·7	—	,,	250–100			
		40	—	−0·58	33·97	27·33	2·22	—	0·21	48·0	7·66	,,	500–250			
		50	—	−0·58	33·97	27·33	2·22	—	0·21	47·5	—	,,	750–500			
		60	—	−0·58	33·97	27·33	2·22	—	0·21	49·6	7·73	,,	1000–750			
		80	—	−0·58	33·98	27·34	2·13	—	0·21	41·0	—	**NHP**	50–0	—	**2135**	
		100	—	−0·87	34·22	27·53	2·43	—	0·16	52·4	6·97	**N 70 B**	88–0	**2304**	**2324**	KT
		150	—	0·61	34·64	27·81	2·68	—	0·00	71·9	4·69	**N 100 B**				
		195	—	1·08	34·69	27·81	2·78	—	0·00	78·8	4·40	**N 70 B**	340–210	**2304**	**2334**	DGP
		295	—	1·10	34·71	27·83	2·68	—	0·00	90·0	4·40	**N 100 B**				
		390	—	0·94	34·72	27·84	2·74	—	0·00	97·4	4·41	**N 100 H**	0–5	**2304**	**2334**	
		590[1]	585	0·69	34·72	27·86	2·79	—	—	98·8	4·43					
		780[1]	784	0·52	34·71	27·87	2·85	—	—	109·2	4·41					
		980[1]	967	0·44	34·70	27·87	2·89	—	—	114·4	4·44					
		1470[1]	1481	0·20	34·69	27·86	2·97	—	—	120·4	4·63					
		1990[2]	1992	−0·02	34·68	27·87	2·97	—	—	118·6	4·85					
		2490[2]	2475	−0·19	34·67	27·87	2·97	—	—	125·7	4·95					
		2980[2]	2986	−0·31	34·67	27·88	3·04	—	—	127·3	5·22					
		3480[2]	3478	−0·39	34·67	27·88	3·04	—	—	120·5	5·31					
		3980[2]	4012?	−0·42	34·67	27·88	3·04	—	—	119·9	5·39					
1356	20	0	—	−0·79	33·89	27·27	1·90	—	0·26	25·8	7·59	**N 50 V**	100–0	**2008**		
		10	—	−0·79	33·89	27·27	1·90	—	0·26	26·3	—	**N 70 V**	50–0			
		20	—	−0·78	33·89	27·27	1·90	—	0·26	27·6	7·61	,,	100–50			
		30	—	−0·78	33·89	27·27	1·90	—	0·26	32·2	—	,,	250–100			
		40	—	−0·78	33·89	27·27	1·90	—	0·26	32·7	7·58	,,	500–250			
		50	—	−0·77	33·89	27·26	1·92	—	0·26	33·3	—	,,	750–500			
		60	—	−0·77	33·89	27·26	2·03	—	0·26	33·5	7·58	,,	1000–750			
		80	—	−1·10	34·07	27·43	2·30	—	0·28	44·8	—	**NHP**	50–0	—	**2135**	
		100	—	−1·14	34·24	27·57	2·51	—	0·07	53·3	6·79	**N 70 B**	111–0	**2315**	**2335**	KT
		150	—	0·20	34·49	27·70	2·62	—	0·00	58·3	5·26	**N 100 B**				
		200	—	1·02	34·61	27·76	2·64	—	0·00	63·4	4·49	**N 70 B**	450–270	**2315**	**2345**	DGP
		300	—	1·33	34·69	27·79	2·57	—	0·00	68·3	4·31	**N 100 H**	0–5	**2316**	**2346**	
		400	—	1·26	34·71	27·82	2·57	—	0·00	72·3	4·33					
		600[1]	616?	1·01	34·72	27·84	2·66	—	—	84·5	4·36					
		800[1]	795	0·77	34·72	27·86	2·66	—	—	91·0	4·38					
		1000[1]	990	0·60	34·71	27·87	2·66	—	—	90·9	4·39					
		1500[1]	1509	0·34	34·70	27·87	2·66	—	—	100·6	4·51					
		2000[1]	2015?	0·15	34·69	27·86	2·72	—	—	104·7	4·67					
		2500[2]	2535?	−0·02	34·67	27·86	2·70	—	—	112·8	4·79					
		3000[2]	3004	−0·18	34·67	27·87	2·81	—	—	117·4	4·95					
		3500[2]	3496	−0·26	34·67	27·87	2·81	—	—	97·4	5·00					
		4000[2]	4001	−0·30	34·67	27·88	2·81	—	—	97·3	5·23					
		4500[2]	4524?	−0·35	34·67	27·88	2·81	—	—	95·7	5·31					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1357	61° 23·7′ S, 24° 12·2′ E	1934 4 v	2000	4983*	WSW	20	WSW	4	os	950·8	−1·3	−1·7	heavy conf. NE and SW × W swells
1358	62° 36·4′ S, 30° 15·6′ E	5 v	2000	5049*	W	25	W	5	csp	957·7	−1·8	−2·0	heavy conf. W swell
1359	63° 45·2′ S, 36° 41·1′ E	6 v	2000	4804*	N × W	21	N × W	4	osp	971·1	−2·2	−2·7	heavy conf. NW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1357	21	0	—	−0·92	33·90	27·28	1·73	—	0·26	31·2	7·61	**N 50 V**	100–0	2017		
		10	—	−0·90	33·90	27·28	1·77	—	0·26	32·1	—	**N 70 V**	50–0			
		20	—	−0·90	33·90	27·28	1·77	—	0·26	31·7	7·63	,,	100–50			
		30	—	−0·90	33·90	27·28	1·86	—	0·26	33·3	—	,,	250–100			
		40	—	−0·90	33·90	27·28	1·84	—	0·26	33·9	7·62	,,	500–250			
		50	—	−0·90	33·90	27·28	1·90	—	0·26	36·1	—	,,	750–500			
		60	—	−0·90	33·90	27·28	1·90	—	0·25	36·8	7·59	,,	1000–750			
		80	—	−1·28	34·22	27·54	2·30	—	0·21	56·2	—	**NHP**	50–0	—	2150	
		100	—	−0·98	34·30	27·60	2·38	—	0·00	58·6	6·70	**N 70 B**	100–0	2323	2343	KT
		150	—	1·08	34·57	27·72	2·49	—	0·00	66·5	4·58	**N 100 B**				
		200	—	1·42	34·67	27·77	2·49	—	0·00	71·1	4·25	**N 70 B**	390–260	2323	2354	DGP
		300	—	1·51	34·72	27·81	2·43	—	0·00	74·7	4·23	**N 100 B**				
		400	—	1·43	34·74	27·83	2·66	—	0·00	78·1	4·28					
		600[1]	603	1·13	34·73	27·84	2·68	—	—	81·1	4·29					
		800[1]	—	0·91	34·73	27·86	2·79	—	—	90·6	4·31					
		990[1]	990	0·73	34·73	27·87	2·89	—	—	94·9	4·38					
		1490[1]	1484	0·41	34·71	27·88	2·93	—	—	100·1	4·46					
		1980[1]	1980	0·21	34·70	27·88	2·93	—	—	105·5	4·63					
		2500[2]	2531?	0·02	34·68	27·87	2·83	—	—	110·2	4·70					
		3000[2]	2982	−0·10	34·67	27·87	2·91	—	—	107·8	4·89					
		3500[2]	3499	−0·23	34·67	27·87	2·93	—	—	110·3	5·09					
		4000[2]	—	−0·31	34·67	27·88	2·93	—	—	109·7	5·09					
		4500[2]	4524?	−0·35	34·67	27·88	2·93	—	—	112·7	5·25					
1358	22	0	—	−1·26	33·87	27·27	2·03	—	0·24	33·6	7·70	**N 50 V**	100–0	2016		
		5	—	−1·26	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·26	33·87	27·27	1·81	—	0·23	33·9	—	,,	100–50			
		20	—	−1·24	33·87	27·27	1·79	—	0·24	34·7	7·66	,,	250–100			
		30	—	−1·24	33·87	27·27	1·79	—	0·24	35·5	—	,,	500–250			
		40	—	−1·24	33·87	27·27	1·79	—	0·24	35·0	7·63	,,	750–500			
		50	—	−1·24	33·87	27·27	1·81	—	0·23	35·8	—	,,	1000–750			
		60	—	−1·33	34·09	27·44	2·22	—	0·36	41·6	7·25	**NHP**	50–0	—	2145	
		80	—	−1·22	34·21	27·54	2·36	—	0·10	47·9	—	**CWS**	0			
		100	—	−0·63	34·29	27·58	2·45	—	0·00	51·0	6·26	,,	5			
		150	—	1·22	34·57	27·71	2·72	—	0·00	62·9	4·42	,,	10			
		200	—	1·48	34·64	27·75	2·76	—	0·00	67·1	4·21	,,	20			
		300	—	1·67	34·71	27·79	2·76	—	0·00	69·5	4·11	,,	50			
		395	—	1·66	34·73	27·80	2·62	—	0·00	74·7	4·18	,,	100			
		590[1]	589	1·43	34·74	27·83	2·70	—	—	80·2	4·26	**N 70 B**	106–0	2314	2334	KT
		790[1]	811	1·13	34·74	27·85	2·70	—	—	83·5	4·30	**N 100 B**				
		990[1]	987	0·88	34·73	27·86	2·70	—	—	87·4	4·38	**N 70 B**	450–200	2314	2344	DGP
		1480[1]	1476	0·52	34·71	27·87	2·72	—	—	94·0	4·44	**N 100 B**				
		1980[1]	1984	0·28	34·69	27·85	2·72	—	—	97·9	4·60					
		2490[2]	2498	0·09	34·68	27·87	2·81	—	—	100·3	4·71					
		2990[2]	2973	−0·09	34·68	27·88	2·91	—	—	104·7	4·86					
		3490[2]	3478	−0·20	34·67	27·87	2·93	—	—	109·2	4·97					
		3980[2]	4005	−0·28	34·67	27·88	2·93	—	—	108·8	5·11					
		4480[2]	4480	−0·34	34·67	27·88	2·95	—	—	103·0	5·25					
1359	23	0	—	−1·37	33·95	27·33	1·81	—	0·23	33·7	7·63	**N 50 V**	100–0	2014		
		5	—	−1·37	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·37	33·95	27·33	1·79	—	0·25	33·7	—	,,	100–50			
		20	—	−1·37	33·95	27·33	1·67	—	0·25	34·7	7·66	,,	250–100			
		30	—	−1·37	33·95	27·33	1·75	—	0·24	36·6	—	,,	500–250			
		40	—	−1·37	33·95	27·33	1·75	—	0·24	37·4	7·63	,,	750–500			
		50	—	−1·37	33·95	27·33	1·81	—	0·24	37·6	—	,,	1000–750			
		60	—	−1·37	33·95	27·33	1·81	—	0·25	37·7	7·60	**NHP**	50–0	—	2147	
		80	—	−1·60	34·24	27·58	2·13	—	0·33	50·6	—	**CWS**	0			
		100	—	−1·20	34·30	27·61	2·13	—	0·09	55·1	6·58	,,	5			
		150	—	1·02	34·58	27·73	2·32	—	0·00	71·4	4·39	,,	10			
		200	—	1·42	34·66	27·76	2·47	—	0·00	80·1	4·16	,,	20			
		300	—	1·55	34·70	27·79	2·55	—	0·00	85·0	4·13	,,	50			
		400	—	1·53	34·73	27·81	2·49	—	0·00	87·9	4·19	,,	100			
		600[1]	601	1·31	34·74	27·84	2·47	—	—	97·3	4·23	**N 70 B**	100–0	2316	2336	KT
		800[1]	789	1·11	34·73	27·84	2·47	—	—	100·4	4·33	**N 100 B**				
		1000[1]	1017	0·87	34·71	27·85	2·62	—	—	104·2	4·40	**N 70 B**	410–210	2316	2346	DGP. **N 100 B** did not fish properly
		1500[1]	1502	0·51	34·70	27·86	2·59	—	—	110·7	4·43	**N 100 B**				
		2000[1]	2012	0·31	34·70	27·87	2·43	—	—	118·8	4·58	**N 100 H**	0–5	2315	2346	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1359 *cont.*	63° 45·2′ S, 36° 41·1′ E	1934 6 v											
1360	64° 27′ S, 41° 08·9′ E	7 v	2000	4195*	E×N	25	E×N	4	o	976·8	−2·9	−3·3	heavy conf. ENE swell
1361	64° 37·6′ S, 44° 16·3′ E	8 v	1600	4040*	E	26	E	4	os	985·0	−6·7	−6·9	heavy conf. ENE swell
1362	61° 45·5′ S, 44° 15·9′ E	9–10 v	2000 0000	4974* —	Lt airs NE	0–1 3	— NE	1 1	b bcs	987·5 987·8	−2·9 −3·2	−3·3 −3·3	ill defined swell low conf. swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1359 *cont.*	23	2500^2	2509	0·09	34·69	27·87	2·66	—	—	112·7	4·75					
		3000^2	3007	−0·09	34·69	27·88	2·70	—	—	106·5	4·87					
		3500^2	3435?	−0·21	34·68	27·88	2·70	—	—	111·3	5·01					
		4000^2	3992	−0·28	34·67	27·88	2·70	—	—	113·3	5·19					
		4500^2	4506	−0·32	34·67	27·88	2·72	—	—	109·7	5·25					
1360	24	0	—	−1·60	34·00	27·38	2·22	—	0·19	40·9	7·59	N 70 V	50–0	2015	—	−3 hours
		5	—	−1·60	—	—	—	—	—	—	—	,,	100–50			
		10	—	−1·60	34·00	27·38	2·22	—	0·19	41·2	—	,,	250–100			
		20	—	−1·60	34·00	27·38	2·24	—	0·18	43·0	7·63	,,	500–250			
		30	—	−1·60	34·00	27·38	2·26	—	0·19	41·4	—	,,	750–500			
		40	—	−1·60	34·00	27·38	2·32	—	0·19	40·5	7·58	,,	1000–750			
		50	—	−1·60	34·00	27·38	2·32	—	0·19	41·0	—	NHP	50–0	—	2205	
		60	—	−1·60	34·00	27·38	2·32	—	0·19	41·4	7·56	CWS	0			
		80	—	−0·70	34·25	27·55	2·47	—	0·27	49·5	—	,,	5			
		100	—	1·12	34·60	27·73	2·97	—	0·07	70·0	4·23	,,	10			
		150	—	1·41	34·67	27·77	2·97	—	0·00	77·7	4·09	,,	20			
		200	—	1·47	34·69	27·78	2·97	—	0·00	85·2	4·15	,,	50			
		300	—	1·47	34·71	27·81	2·78	—	0·00	85·2	4·16	,,	100			
		400	—	1·44	34·72	27·81	2·83	—	0·00	90·0	4·26	N 100 B	128–0	2321	2341	KT
		600^1	596	1·23	34·74	27·85	2·83	—	—	91·0	4·27	N 70 B	520–120	2321	2351	DGP
		800^1	796	1·05	34·73	27·85	2·89	—	—	100·3	4·32	N 100 B				
		1000^1	1011	0·84	34·72	27·85	2·89	—	—	102·6	4·38	N 100 H	0–5	2322	2353	
		1500^1	1513	0·43	34·70	27·87	2·89	—	—	105·7	4·53					
		2000^2	2063?	0·22	34·69	27·86	2·97	—	—	111·8	4·64					
		2500^2	2525?	0·01	34·69	27·87	2·97	—	—	111·7	4·94					
		3000^2	3000	−0·14	34·69	27·88	2·97	—	—	110·1	5·00					
		3500^2	3501	−0·24	34·68	27·88	2·97	—	—	113·3	5·07					
		4000^2	3991	−0·34	34·66	27·87	2·97	—	—	106·9	5·31					
1361	25	0	—	−1·77	34·08	27·46	2·47	—	0·23	36·8	7·57	N 50 V	100–0	1615		
		5	—	−1·77	—	—	—	—	—	—	—	N 70 V	50–0			
		10	—	−1·76	34·08	27·46	2·47	—	0·23	37·3	—	,,	100–50			
		20	—	−1·76	34·08	27·46	2·41	—	0·23	38·0	7·57	,,	250–100			
		30	—	−1·76	34·08	27·46	2·47	—	0·23	39·3	—	,,	500–250			
		40	—	−1·76	34·08	27·46	2·47	—	0·24	39·0	7·61	,,	750–500			
		50	—	−1·77	34·08	27·46	2·47	—	0·24	40·5	—	,,	1000–750			
		60	—	−1·74	34·08	27·46	2·47	—	0·24	40·2	7·61	NHP	50–0	—	1737	
		80	—	−1·73	34·08	27·45	2·47	—	0·24	41·7	—	CWS	0			
		100	—	−1·51	34·33	27·64	2·62	—	0·14	42·2	6·64	,,	5			
		150	—	0·24	34·55	27·76	2·83	—	0·00	54·6	5·06	,,	10			
		200	—	0·71	34·61	27·78	2·93	—	0·00	67·2	4·72	,,	20			
		300	—	1·11	34·67	27·79	2·62	—	0·00	70·5	4·43	,,	50			
		400	—	1·08	34·70	27·83	2·76	—	0·00	78·0	4·48	,,	100			
		600^1	—	1·12	34·72	27·83	2·76	—	—	86·3	4·26	N 70 B	164–0	1921	1941	KT
		800^1	—	0·89	34·71	27·85	—	—	—	—	4·24	N 100 B				
		1000^1	—	0·74	34·70	27·85	2·83	—	—	87·6	4·23	N 70 B	530–210	1921	1951	DGP. **N 100 B** did not fish properly
												N 100 B				
1362	26	0	—	−1·10	33·88	27·28	2·45	—	0·29	38·4	7·65	N 50 V	100–0	2130		
		5	—	−1·10	—	—	—	—	—	—	—	N 70 V	50–0			
		10	—	−1·11	33·91	27·30	2·45	—	0·30	39·1	—	,,	100–50			
		20	—	−1·09	33·91	27·30	2·45	—	0·30	39·9	7·65	,,	250–100			
		30	—	−1·09	33·91	27·30	2·45	—	0·31	36·1	—	,,	500–250			
		40	—	−1·09	33·91	27·30	2·45	—	0·30	40·0	7·62	,,	750–500			
		50	—	−1·09	33·91	27·30	2·45	—	0·31	40·0	—	NHP	50–0	—	2307	
		60	—	−1·10	33·91	27·30	2·51	—	0·30	40·4	7·61	CWS	0			
		80	—	−1·51	34·11	27·47	2·60	—	0·41	44·5	—	,,	5			
		100	—	−1·20	34·18	27·52	2·74	—	0·09	47·6	6·77	,,	10			
		150	—	0·98	34·48	27·65	3·02	—	0·00	65·7	4·65	,,	20			
		200	—	1·53	34·61	27·72	3·02	—	0·00	70·0	4·16	,,	50			
		300	—	1·70	34·65	27·73	3·06	—	0·00	75·9	4·06	,,	100			
		400	—	1·75	34·69	27·76	2·81	—	0·00	84·0	4·10	N 70 B	110–0	0019	0039	KT
		600^1	588	1·54	34·71	27·80	2·93	—	—	93·0	4·02	N 100 B				
		800^1	—	1·38	34·72	27·82	2·95	—	—	101·7	4·11	N 70 B	520–200	0019	0049	DGP. **N 100 B** did not fish properly
		1000^1	—	1·19	34·72	27·83	2·79	—	—	107·7	4·17	N 100 B				
		1500^1	—	0·70	34·71	27·86	2·85	—	—	119·3	4·23	N 100 H	0–5	0020	0050	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1362 *cont.*	61° 45·5′ S, 44° 15·9′ E	1934 9–10 v											
1363	59° 14′ S, 44° 27·9′ E	10–11 v	2000	5144*	Lt airs	0–1	—	1	cspg	983·6	−1·7	−1·7	low conf. E swell
			0000	—	Lt airs	0–1	—	1	bcs	985·1	−1·6	−1·6	low conf. E swell
1364	56° 38·6′ S, 44° 45·4′ E	11–12 v	2000	4894*	W	12	W	4	c	1004·2	−1·7	−1·8	mod. conf. E swell
			0000	—	NW × N	10	NW × N	3	c	1004·7	−2·5	−2·8	mod. conf. swell
1365	55° 12·8′ S, 44° 52·5′ E	12–13 v	2000	4155*	WNW	30	WNW	6	b	982·3	1·1	0·6	heavy conf. WNW swell
			0000	—	WNW	25	WNW	6	bc	984·2	1·4	0·9	heavy WNW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	Mg.—atom m.³				O₂ c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N₂	Nitrite N₂	Si				From	To	
1362 *cont.*	26	2000[1]	2004	0·43	34·70	27·87	2·91	—	—	117·2	4·40					
		2500[2]	—	0·21	34·69	27·86	3·02	—	—	124·2	4·44					
		3000[2]	—	−0·01	34·69	27·87	3·02	—	—	126·3	4·51					
		3500[2]	—	−0·14	34·68	27·88	2·98	—	—	124·7	4·48					
		4000[2]	—	−0·24	34·67	27·87	2·98	—	—	125·2	4·70					
		4500[2]	4516	−0·30	34·66	27·87	2·98	—	—	125·2	4·98					
1363	27	0	—	−0·11	33·82	27·19	2·28	—	0·32	26·8	7·52	**N 50 V**	100–0	**2145**		
		5	—	−0·10	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·10	33·82	27·19	2·38	—	0·32	28·0	—	,,	100–50			
		20	—	−0·10	33·82	27·19	2·38	—	0·32	29·0	7·55	,,	250–100			
		30	—	−0·10	33·82	27·19	2·38	—	0·32	29·3	—	,,	500–250			
		40	—	−0·12	33·83	27·20	2·38	—	0·31	29·8	7·51	,,	750–500			
		50	—	−0·17	33·83	27·20	2·38	—	0·30	30·9	—	**NHP**	50–0	—	**2337**	
		60	—	−0·18	33·83	27·20	2·38	—	0·31	30·7	7·51	**CWS**	0			
		80	—	−0·28	33·86	27·21	2·41	—	0·29	31·7	—	,,	5			
		100	—	−0·51	34·10	27·42	2·59	—	0·19	45·3	6·72	,,	10			
		150	—	0·71	34·39	27·60	2·79	—	0·00	55·6	5·07	,,	20			
		195	—	1·36	34·49	27·63	2·97	—	0·00	61·0	4·41	,,	50			
		295	—	1·84	34·63	27·71	2·97	—	0·00	69·6	3·94	,,	100			
		390	—	1·91	34·69	27·75	2·98	—	0·00	76·3	4·00	**N 70 B**	121–0	**0059**	**0119**	KT
		590	—	1·86	34·74	27·80	2·87	—	—	81·7	4·15	**N 100 B**				
		780[1]	—	1·71	34·74	27·81	2·91	—	—	88·2	4·36	**N 70 B**	420–280	**0059**	**0129**	DGP
		980[1]	964	1·53	34·74	27·82	2·91	—	—	94·0	4·63	**N 100 B**				
		1470[1]	—	1·01	34·72	27·84	2·91	—	—	96·4	4·87	**N 100 H**	0–5	**0059**	**0129**	
		1960[1]	—	0·64	34·70	27·85	3·06	—	—	101·5	4·78					
		2440[1]	2458	0·39	34·69	27·85	3·06	—	—	111·0	4·92					
		3000[2]	2999	0·25	34·69	27·86	3·06	—	—	114·9	3·92					
		3500[2]	—	0·13	34·68	27·86	3·06	—	—	120·0	4·23					
		3990[2]	3992	−0·07	34·67	27·86	3·06	—	—	125·2	4·26					
		4490[2]	—	−0·18	34·66	27·86	3·02	—	—	125·7	4·31					
		4990[2]	—	−0·23	34·65	27·85	2·98	—	—	124·2	4·43					
1364	28	0	—	0·21	33·78	27·14	2·28	—	0·32	25·0	7·58	**N 50 V**	100–0	**2145**		
		5	—	0·21	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·20	33·78	27·14	2·28	—	0·32	25·0	—	,,	100–50			
		20	—	0·20	33·78	27·14	2·28	—	0·32	25·9	7·57	,,	250–100			
		30	—	0·20	33·78	27·14	2·32	—	0·32	26·2	—	,,	500–250			
		40	—	0·20	33·78	27·14	2·34	—	0·31	26·6	7·53	**NHP**	50–0	—	**2330**	
		50	—	0·20	33·78	27·14	2·32	—	0·31	26·9	—	**CWS**	0			
		60	—	0·20	33·78	27·14	2·40	—	0·31	27·4	7·52	,,	5			
		80	—	0·20	33·78	27·14	2·49	—	0·31	27·6	—	,,	10			
		100	—	0·18	33·78	27·14	2·49	—	0·32	27·7	7·48	,,	20			
		150	—	−0·86	34·11	27·45	2·78	—	0·00	45·9	6·75	,,	50			
		200	—	1·06	34·46	27·63	3·16	—	0·00	63·4	4·65	,,	100			
		300	—	1·79	34·62	27·71	3·19	—	0·00	74·2	3·95	**N 70 B**	130–0	**0019**	**0039**	KT
		400	—	1·85	34·69	27·75	3·08	—	0·00	82·8	3·97	**N 100 B**				
		600[1]	—	1·79	34·71	27·78	2·89	—	—	87·3	4·17	**N 70 B**	500–200	**0019**	**0049**	Depths estimated. **N 100 B** did not fish properly
		800[1]	—	1·68	34·74	27·81	2·89	—	—	90·7	4·31	**N 100 B**				
		1000[2]	—	1·45	34·74	27·83	—	—	—	—	4·93	**N 100 H**	0–5	**0020**	**0050**	
		1500[3]	—	0·90	34·72	27·85	2·89	—	—	100·0	3·96					
		2000[4]	2007	0·53	34·70	27·86	2·95	—	—	110·5	4·17					
		2500[5]	2512	0·31	34·69	27·85	3·04	—	—	115·3	4·51					
		3000[5]	—	0·07	34·68	27·87	3·04	—	—	122·6	4·55					
		3500[5]	3517	−0·08	34·67	27·86	3·04	—	—	126·3	4·92					
		4000[6]	—	−0·20	34·66	27·86	3·04	—	—	127·4	4·69					
1365	29	0	—	0·27	33·81	27·16	2·19	—	0·36	24·7	7·56	**N 50 V**	100–0	**2138**		
		5	—	0·27	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·27	33·81	27·16	2·19	—	0·34	25·2	—	,,	100–50			
		20	—	0·27	33·81	27·16	2·20	—	0·34	27·9	7·53	,,	250–100			
		30	—	0·27	33·81	27·16	2·20	—	0·35	28·1	—	,,	500–250			
		40	—	0·27	33·81	27·16	2·20	—	0·35	29·8	7·50	,,	750–500			
		50	—	0·27	33·81	27·16	2·20	—	0·34	30·3	—	**NHP**	50–0	—	**2313**	
		60	—	0·27	33·81	27·16	2·20	—	0·37	30·5	7·49	**CWS**	0			
		80	—	0·24	33·82	27·17	2·20	—	0·37	31·8	—	,,	5			
		100	—	−0·97	34·04	27·39	2·45	—	0·36	37·4	7·23	,,	10			
		150	—	−0·09	34·30	27·57	2·68	—	0·00	54·5	5·83	,,	20			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1365 *cont.*	55° 12·8′ S, 44° 52·5′ E	1934 12–13 v											
1366	50° 42·3′ S, 44° 54·1′ E	14 v	2000	4142*	SW × W	35	SW × W	6	cqh	1009·2	−0·5	−0·9	heavy conf. WSW swell
1367	47° 41·2′ S, 44° 42·7′ E	15 v	2000	3581*	WSW	20	WSW	4	bc	1027·9	3·3	1·8	heavy WSW swell
1368	44° 54·6′ S, 42° 30·1′ E	16 v	2000	955*	NNW	12	NNW	3	bc	1029·3	7·2	5·9	mod. NW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1365 *cont.*	29	200	—	1·23	34·47	27·63	2·87	—	0·00	54·9	4·51	**CWS**	50			
		300	—	1·73	34·62	27·72	2·87	—	0·00	59·8	4·00	,,	100			
		400	—	1·85	34·69	27·75	2·87	—	0·00	66·3	4·04	**N 100 B**	113–0	**2344**	**0004**	KT
		600^1	601	1·75	34·72	27·79	2·30	—	—	70·9	4·05	**N 70 B**	520–200	**2344**	**0014**	DGP. **N 100 B** did not fish properly
		790^2	—	1·62	34·74	27·82	2·51	—	—	75·7	4·17	**N 100 B**				
		990^2	—	1·42	34·73	27·82	2·59	—	—	87·0	4·28					
		1490^2	1487	0·90	34·71	27·85	2·79	—	—	95·2	4·41					
		2000^3	2005	0·52	34·69	27·84	2·85	—	—	106·4	4·31					
		2500^3	—	0·27	34·68	27·86	2·68	—	—	116·2	4·53					
		3000^3	—	0·07	34·67	27·86	2·68	—	—	109·4	4·55					
		3500^3	—	−0·13	34·66	27·86	2·68	—	—	105·2	4·70					
		4000^3	4013	−0·25	34·66	27·86	2·68	—	—	104·2	4·92					
1366	1	0	—	1·79	33·87	27·11	2·32	—	0·35	14·1	7·31	**N 70 V**	50–0	**2018**		
		5	—	1·75	—	—	—	—	—	—	—	,,	100–50			
		10	—	1·79	33·87	27·11	2·32	—	0·36	14·5	—	,,	250–100			
		20	—	1·79	33·87	27·11	2·32	—	0·36	16·6	7·29	,,	500–250			
		30	—	1·79	33·87	27·11	2·32	—	0·36	17·1	—	,,	750–500			
		40	—	1·81	33·87	27·11	2·32	—	0·35	17·2	7·25	,,	1000–750			
		50	—	1·81	33·87	27·11	2·32	—	0·36	18·9	—	**NHP**	50–0	—	**2140**	
		60	—	1·81	33·87	27·11	2·32	—	0·34	19·1	7·26	**CWS**	0			
		80	—	1·81	33·88	27·12	2·40	—	0·34	19·9	—	,,	5			
		100	—	1·81	33·89	27·12	2·45	—	0·34	21·1	7·21	,,	10			
		150	—	1·31	34·13	27·34	2·78	—	0·00	33·8	6·12	,,	20			
		200	—	1·59	34·23	27·41	3·14	—	0·00	35·5	5·37	,,	50			
		300	—	1·85	34·39	27·52	3·04	—	0·00	48·6	4·61	,,	100			
		400	—	2·16	34·48	27·57	3·04	—	0·00	54·0	4·15	**N 100 B**	91–0	**2211**	**2231**	KT
												N 70 B	400–200	**2211**	**2241**	DGP. **N 100 B** torn
												N 100 B				
1367	2	0	—	4·38	33·78	26·80	1·86	—	0·30	<5·0	6·94	**N 50 V**	100–0	**2150**		
		5	—	4·33	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	4·33	33·78	26·81	1·86	—	0·30	<5·0	—	,,	100–50			
		20	—	4·33	33·78	26·81	1·84	—	0·30	<5·0	6·92	,,	250–100			
		30	—	4·33	33·78	26·81	1·86	—	0·31	<5·0	—	,,	500–250			
		40	—	4·31	33·78	26·81	1·86	—	0·31	<5·0	6·92	**NHP**	50–0	—	**2223**	
		50	—	4·31	33·78	26·81	1·86	—	0·31	<5·0	—	**CWS**	0			
		60	—	4·31	33·78	26·81	1·86	—	0·31	<5·0	6·91	,,	5			
		80	—	4·31	33·78	26·81	1·86	—	0·31	<5·0	—	,,	10			
		100	—	4·31	33·79	26·82	1·90	—	0·32	<5·0	6·89	,,	20			
		150	—	3·64	34·04	27·08	2·28	—	0·00	11·0	6·33	,,	50			
		200	—	3·59	34·16	27·18	2·45	—	0·00	17·3	6·01	,,	100			
		300	—	3·19	34·21	27·26	2·55	—	0·00	22·5	5·72	**N 70 B**	97–0	**2251**	**2311**	KT
		400	—	3·01	34·27	27·33	2·62	—	0·00	28·5	5·21	**N 100 B**				
		600^1	—	2·72	34·36	27·42	3·08	—	—	38·4	4·64	**N 70 B**	450–230	**2251**	**2321**	DGP. **N 100 B** did not fish properly
		800^1	—	2·49	34·44	27·51	3·08	—	—	48·0	4·22	**N 100 B**				
		1000^2	985	2·46	34·57	27·61	3·12	—	—	58·9	3·71					
		1490^2	—	2·41	34·75	27·76	2·87	—	—	60·8	3·95					
		1990^2	—	2·06	34·78	27·81	2·68	—	—	68·1	4·10					
		2490^2	2502	1·68	34·77	27·83	2·47	—	—	73·5	4·29					
		2990^2	—	1·18	34·75	27·86	2·85	—	—	79·5	4·24					
1368	3	0	—	7·54	33·86	26·46	1·63	—	0·31	<5·0	6·46	**N 50 V**	100–0	**2050**		
		10	—	7·53	33·86	26·46	1·63	—	0·31	<5·0	—	**NHP**	50–0	—	**2105**	
		20	—	7·13	33·86	26·52	1·63	—	0·31	<5·0	6·52	**N 70 B**	106–0	**2149**	**2209**	KT
		30	—	7·05	33·86	26·53	1·69	—	0·32	<5·0	—	**N 100 B**				
		40	—	6·75	33·86	26·57	1·69	—	0·33	<5·0	6·55	**N 70 B**	490–200	**2149**	**2219**	DGP. **N 100 B** did not fish properly
		50	—	6·55	33·86	26·60	1·69	—	0·33	<5·0	—	**N 100 B**				
		60	—	6·53	33·86	26·60	1·75	—	0·34	<5·0	6·57					
		80	—	6·51	33·86	26·60	1·81	—	0·34	<5·0						
		95	—	6·29	33·89	26·66	1·88	—	0·34	<5·0	6·54					
		145	—	5·16	34·04	26·91	2·13	—	0·00	8·3	6·43					
		190	—	4·59	34·08	27·02	2·19	—	0·00	13·0	6·34					
		285	—	4·27	34·14	27·10	2·40	—	0·00	17·9	5·99					
		380	—	3·77	34·18	27·18	2·64	—	0·00	19·1	5·68					
		570^1	566	3·24	34·26	27·29	2·19	—	—	28·4	5·09					
		760^1	—	2·75	34·37	27·43	2·41	—	—	42·1	4·42					
		850^1	858	2·65	34·41	27·47	2·81	—	—	43·5	4·24					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1369	42° 25·8′ S, 40° 22·6′ E	1934 17 v	2000	2825*	N	22	N	4	b	1017·9	12·2	11·7	mod. N swell
1370	39° 46·6′ S, 38° 18·4′ E	18 v	2000	4680*	NW	0–1	NW	2	b	1021·2	16·1	15·6	low conf. NW swell
1371	36° 42·4′ S, 36° 04·4′ E	19 v	2000	5384*	NNE	7	NNE	2	bc	1018·9	20·0	18·3	low NE swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	Mg.—atom m.³				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1369	4	0	—	8·72	33·88	26·31	1·41	—	0·28	0·0	6·39	**N 50 V**	100–0	**2130**		
		10	—	8·72	33·88	26·31	1·43	—	0·28	0·0	—	**NHP**	50–0	—	**2140**	
		20	—	8·68	33·88	26·32	1·43	—	0·27	0·0	6·39	**N 70 B**	117–0	**2205**	**2225**	KT
		30	—	8·68	33·88	26·32	1·43	—	0·27	0·0	—	**N 100 B**				
		40	—	8·68	33·88	26·32	1·43	—	0·26	0·0	6·34	**N 70 B**	520–300	**2205**	**2235**	DGP. **N 100 B** did not fish properly
		50	—	8·66	33·88	26·32	1·43	—	0·27	0·0	—	**N 100 B**				
		60	—	8·59	33·89	26·33	1·43	—	0·26	0·0	6·34					
		80	—	8·23	33·89	26·39	1·46	—	0·34	0·0						
		95	—	7·25	33·94	26·57	1·52	—	0·46	0·0	6·36					
		145	—	5·13	34·00	26·89	1·77	—	0·00	8·3	6·49					
		195	—	4·48	34·04	26·99	1·86	—	0·00	10·1	6·45					
		290	—	3·63	34·04	27·08	1·96	—	0·00	16·6	6·33					
		385^1	—	3·69	34·17	27·18	2·26	—	0·00	18·6	5·71					
		580^1	—	3·07	34·23	27·29	2·15	—	—	27·1	5·22					
		770^2	767	2·71	34·35	27·42	2·26	—	—	38·6	4·50					
		960^2	—	2·67	34·49	27·52	2·07	—	—	52·5	3·88					
		1440^2	—	2·47	34·68	27·70	2·41	—	—	59·2	3·94					
		1920^2	1927	2·43	34·78	27·78	2·55	—	—	58·4	4·15					
		2410^2	—	2·17	34·80	27·82	2·49	—	—	57·9	4·34					
1370	5	0	—	15·28	35·22	26·10	0·38	—	0·22	0·0	5·46	**N 50 V**	100–0	**2110**	—	−2 hours
		10	—	15·28	35·22	26·10	0·38	—	0·21	0·0	—	**NHP**	50–0	—	**2127**	
		20	—	15·23	35·22	26·12	0·38	—	0·22	0·0	5·44	**N 70 B**	113–0	**2322**	**2342**	KT
		30	—	15·23	35·22	26·12	0·38	—	0·22	0·0	—	**N 100 B**				
		40	—	15·23	35·22	26·12	0·38	—	0·23	0·0	5·41	**N 70 B**	410–160	**2322**	**2353**	DGP. **N 100 B** did not fish properly
		50	—	15·18	35·22	26·13	0·38	—	0·26	0·0	—	**N 100 B**				
		60	—	15·13	35·20	26·12	0·38	—	0·28	0·0	5·36					
		80	—	14·48	35·15	26·22	0·48	—	0·24	0·0						
		95	—	13·65	35·14	26·39	0·82	—	0·00	0·0	4·95					
		145	—	12·45	35·08	26·58	1·05	—	0·00	0·0	4·88					
		190	—	11·71	35·02	26·68	1·14	—	0·00	0·0	4·96					
		290	—	10·22	34·90	26·86	1·18	—	0·00	0·0	5·11					
		385	—	8·93	34·68	26·90	1·39	—	0·00	8·7	4·98					
		570^1	572	7·13	34·55	27·07	1·41	—	—	18·6	4·39					
		770^1	—	5·13	34·42	27·21	1·33	—	—	24·2	4·21					
		960^1	—	3·61	34·39	27·37	1·10?	—	—	36·7	4·21					
		1440^1	1440	2·97	34·64	27·63	1·05?	—	—	49·0	4·17					
		1920^1	—	2·62	34·78	27·77	1·46?	—	—	51·3	3·56					
		2440^2	2435	2·41	34·81	27·81	1·46	—	—	53·6	4·37					
		2920^2	—	2·15	34·81	27·84	1·46	—	—	56·4	4·35					
		3410^2	—	1·62	34·80?	27·87?	1·77	—	—	62·9	4·52					
		3900^2	3901	1·23	34·73	27·84	1·29	—	—	71·5	4·42					
		4390^2	—	0·80	34·72	27·85	0·97	—	—	79·8	4·41					
1371	6	0	—	21·40	35·59	24·85	0·19	—	0·00	0·0	4·83	**N 50 V**	100–0	**2130**		
		10	—	21·40	35·59	24·85	0·19	—	0·00	0·0	—	**NHP**	50–0	—	**2150**	
		20	—	21·40	35·59	24·85	0·19	—	0·00	0·0	4·84	**N 70 B**	146–0	**2325**	**2345**	KT
		30	—	21·40	35·59	24·85	0·19	—	0·00	0·0	—	**N 100 B**				
		40	—	21·40	35·59	24·85	0·19	—	0·00	0·0	4·83	**N 70 B**	450–170	**2325**	**2355**	Estimated depths. **N 100 B** did not fish properly
		50	—	21·25	35·59	24·89	0·19	—	0·00	0·0	—	**N 100 B**				
		60	—	20·60	35·60	25·08	0·19	—	0·09	0·0	4·78					
		80	—	20·10	35·61	25·22	0·19	—	0·06	0·0						
		100	—	20·07	35·61	25·23	0·19	—	0·06	0·0	4·84					
		150	—	18·98	35·57	25·48	0·38	—	0·00	0·0	4·46					
		200	—	17·63	35·52	25·77	0·44	—	0·00	0·0	4·56					
		300	—	16·60	35·52	26·02	0·48	—	0·00	0·0	4·45					
		400^1	—	15·38	35·44	26·24	0·63	—	0·00	0·0	4·37					
		600^1	—	12·88	35·23	26·61	0·91	—	—	0·0	4·66					
		800^2	795	10·84	34·95	26·79	1·01	—	—	7·8	4·49					
		1000^2	—	8·69	34·69	26·94	1·03	—	—	15·3	4·39					
		1490^2	—	3·81	34·47	27·41	1·58	—	—	38·3	3·82					
		1990^2	—	2·85	34·68	27·67	2·17	—	—	50·1	3·56					
		2490^2	2489	2·58	34·78	27·77	1·14	—	—	57·5	4·08					
		3000^3	3008	2·33	34·81	27·82	1·69	—	—	54·1	4·25					
		3500^3	—	1·93	34·81	27·85	0·59?	—	—	57·3	4·36					
		4000^3	—	1·38	34·76	27·85	1·20	—	—	79·3	4·49					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1372	34° 01·8′ S, 34° 01·7′ E	1934 20 v	2000	2511*	NE × E	7	NE × E	2	b	1014·0	21·4	20·3	low NE swell
1373	31° 13·1′ S, 31° 48·7′ E	21 v	2000	3003*	—	0	—	0	bc	1013·4	21·7	19·4	no swell
1374	31° 46·6′ S, 29° 46·3′ E	24 v	2100	2234*	SW	10	SW	2	c	1014·2	22·7	17·7	low conf. E and SW swells
1375	34° 30·8′ S, 26° 19′ E	25 v	2100	2838*	SW × W	25	SW	5	b	1017·2	20·6	17·2	heavy WSW swell
1376	35° 51·9′ S, 13° 01·6′ E	2 viii	2200	4656*	WSW	21	WSW	4	bcq	1019·3	15·0	11·1	heavy WSW swell
1377	38° 36·4′ S, 09° 03·3′ E	4 viii	2200	5196*	SE	14	SE	4	bc	1029·1	6·7	4·2	heavy conf. SSE swell
1378	41° 17·4′ S, 06° 08·3′ E	5 viii	2200	4802*	N	24	N	5	bcdq	1012·2	9·9	8·2	heavy N × W swell
1379	43° 41·5′ S, 03° 31′ E	6 viii	2200	4647*	SW	25	WSW	5	pcq	1003·6	5·0	4·4	heavy conf. WSW swell
1380	47° 18·3′ S, 01° 10·1′ W	9 viii	2200	3625*	WSW	20	SW	4	o	1021·8	3·3	3·3	heavy conf. SW swell
1381	48° 31·7′ S, 03° 26′ W	10 viii	2200	4058*	N × W	9	W	3	or	1011·5	2·7	2·7	mod. conf. W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. C.	S ‰	σt	Mg.—atom m.^{3}				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1372	7	0	—	21·50	35·61	24·84	<0·10	—	0·00	0·0	4·80	**N 50 V**	100–0	**2119**		
		10	—	21·50	35·61	24·84	<0·10	—	0·00	0·0	—	**NHP**	50–0	—	**2134**	
		20	—	21·50	35·61	24·84	<0·10	—	0·00	0·0	4·79	**N 70 B**	102–0	**2145**	**2205**	KT
		30	—	21·50	35·61	24·84	<0·10	—	0·00	0·0	—	**N 100 B**				
		40	—	21·50	35·61	24·84	<0·10	—	0·00	0·0	4·78	**N 70 B**	370–170	**2145**	**2215**	DGP. **N 100 B** probably did not fish properly
		50	—	21·50	35·61	24·84	<0·10	—	0·00	0·0	—	**N 100 B**				
		60	—	21·45	35·61	24·85	<0·10	—	0·00	0·0	4·76					
		80	—	21·35	35·61	24·88	<0·10	—	0·11	0·0						
		95	—	20·52	35·53	25·05	0·11	—	<0·04	0·0	4·41					
		145	—	18·23	35·53	25·64	0·13	—	0·00	0·0	4·52					
		190	—	17·73	35·60	25·81	0·13	—	0·00	0·0	4·78					
		285	—	16·95	35·54	25·97	0·32	—	0·00	0·0	4·80					
		380	—	15·35	35·44	26·25	0·59	—	0·00	0·0	4·35					
		570	—	12·57	35·21	26·66	0·84	—	—	0·0	4·68					
		760^1	770	10·40	34·91	26·84	1·03	—	—	9·7	4·40					
		950^1	—	7·61	34·61	27·05	1·56	—	—	17·4	4·07					
		1420^1	—	3·44	34·47	27·44	2·79	—	—	45·7	3·76					
		1900^1	—	2·82	34·73	27·71	2·57	—	—	55·4	3·42					
		2280^1	2265	2·55	34·80	27·79	1·81	—	—	56·4	4·00					
1373	8	0	—	24·33	35·29	23·78	<0·10	—	0·00	0·0	4·59	**N 50 V**	100–0	**2130**		
		8	—	24·33	35·29	23·78	<0·10	—	0·00	0·0	—	**NHP**	50–0	—	**2155**	
		16	—	24·23	35·29	23·81	<0·10	—	0·00	0·0	4·58	**N 70 B**	135–0	**2220**	**2240**	KT
		24	—	24·18	35·29	23·83	<0·10	—	0·00	0·0	—	**N 100 B**				
		32	—	23·33	35·29	24·08	<0·10	—	0·14	0·0	4·40	**N 70 B**	410–160	**2220**	**2250**	DGP
		40	—	22·39	35·29	24·35	0·40	—	0·26	0·0	—	**N 100 B**				
		48	—	20·85	35·33	24·80	0·55	—	0·26	0·0	3·92					This station was made in a very strong current; tremendous stray took place on all hoists. The depths of water samples are considered highly doubtful
		64	—	19·20	35·35	25·26	0·74	—	0·12	0·0						
		80	—	18·02	35·37	25·57	0·93	—	0·00	0·0	3·53					
		120	—	15·96	35·37	26·06	0·95	—	0·00	0·0	3·74					
		160	—	14·36	35·32	26·37	1·10	—	0·00	0·0	3·93					
		245	—	12·18	35·17	26·71	1·29	—	0·00	0·0	4·35					
		330	—	10·89	35·00	26·82	1·39	—	0·00	0·0	4·50					
		490	—	8·11	34·72	27·06	2·07	—	—	19·8	3·99					
		650^1	—	6·78	34·65	27·19	2·41	—	—	33·5	3·52					
		820^1	818	4·88	34·49	27·30	2·28	—	—	32·6	3·92?					
		1460^2?	1456?	3·14	34·72	27·67	1·79	—	—	57·4	3·13?					
1374	11	0	—	24·05	35·53	24·05	—	—	—	—	—	**TYFB**	230–0	**2122**	**2212**	DGP
1375	12	0	—	24·20	35·70	24·13	—	—	—	—	—	**TYFB**	210–0	**2124**	**2214**	DGP
1376	22	0	—	16·70	35·73	26·18	—	—	—	—	—	**N 50 V**	100–0	**2206**	**2210**	
												N 70 B	100–0	**2220**	**2240**	KT
												N 100 B				
1377	24	0	—	12·30	34·94	26·50	—	—	—	—	—	**N 50 V**	100–0	**2206**	—	– 1 hour
												NHP	50–0	—	**2217**	
												N 70 B	100–0	**2227**	**2247**	KT
												N 100 B				
1378	25	0	—	8·90	34·35	26·65	—	—	—	—	—	**NHP**	50–0	**2208**	**2220**	
												N 100 B	66–0	**2233**	**2253**	KT
1379	26	0	—	7·15	34·28	26·86	—	—	—	—	—	**N 50 V**	100–0	**2210**		
												NHP	50–0	—	**2227**	
												N 70 B	180–0	**2238**	**2258**	KT
												N 100 B				
1380	29	0	—	3·90	34·03	27·05	—	—	—	—	—	**N 100 B**	180–0	**2208**	**2228**	KT. GMT
1381	1	0	—	2·60	33·93	27·08	—	—	—	—	—	**N 50 V**	100–0	**2206**		
												NHP	50–0	—	**2218**	
												N 70 B	152–0	**2225**	**2245**	KT
												N 100 B				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1382	50° 03·3′ S, 06° 29′ W	1934 11 viii	2206	3455*	SW × W	19	SW × W	4	cs	997·0	−0·5	−1·0	mod. NW swell
1383	51° 08·2′ S, 09° 00·6′ W	12 viii	2200	3392*	W	14	W	4	cs	1008·0	−0·5	−1·6	mod. W swell
1384	51° 58·4′ S, 11° 07·8′ W	13 viii	2200	3709*	S × W	24	S	4	csp	1010·3	−7·2	−7·8	mod. conf. S × W swell
1385	52° 51′ S, 13° 11·1′ W	14 viii	2210	3731*	W × S	24	W × S	4	o	1006·2	−0·4	−0·5	heavy W × S swell
1386	54° 11·9′ S, 15° 47·8′ W	15 viii	2200	4128*	SW × W	10	SW × W	4	bc	987·0	0·0	−0·1	mod. conf. SW swell
1387	54° 54·5′ S, 17° 46·8′ W	16 viii	2205	4466*	SW	30	SW	6	csqp	988·9	−7·5	−8·2	heavy conf. SW swell
1388	55° 18·7′ S, 20° 22·5′ W	17–18 viii	2000	5261*	WNW	30	WNW	4	cqsp	995·1	−1·4	−1·4	mod. conf. W swell
			0000	—	NW × N	25–30	NW	4	s	985·6	−0·6	−0·6	mod. conf. NW swell
1389	53° 38·4′ S, 20° 58′ W	18 viii	2007	4208*	WSW	16	WSW	3	csp	987·6	−0·6	−1·1	mod. conf. W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.^{3}							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σ_t	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O. c.c. litre	Gear	Depth (metres)	From	To	
1382	2	0	—	1·26	33·98	27·24	—	—	—	—	—	**N 50 V**	100–0	**2225**		
												NHP	50–0	—	**2241**	
												N 70 B	180–0	**2247**	**2307**	KT
												N 100 B				
1383	3	0	—	0·20	34·02	27·33	—	—	—	—	—	**N 50 V**	100–0	**2202**	**2207**	
												N 70 B	156–0	**2230**	**2250**	KT
												N 100 B				
1384	4	0	—	−0·15	33·99	27·33	—	—	—	—	—	**N 50 V**	100–0	**2212**	**2219**	
												N 100 B	146–0	**2226**	**2246**	KT
1385	5	0	—	0·10	34·04	27·34	—	—	—	—	—	**N 100 B**	170–0	**2219**	**2239**	KT
1386	5	0	—	−0·25	34·01	27·34	—	—	—	—	—	**N 50 V**	100–0	**2208**	—	+1 hour
												NHP	50–0	—	**2220**	
												N 70 B	180–0	**2228**	**2248**	KT
												N 100 B				
1387	6	0	—	−1·30	33·99	27·37	—	—	—	—	—	**N 50 V**	100–0	**2212**	**2217**	
												N 100 B	137–0	**2230**	**2250**	KT
1388	7	0	—	−1·20	33·99	27·37	2·38	—	0·46	33·7	7·75	**N 50 V**	100–0	**2018**		
		5	—	−1·20	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·20	33·99	27·37	2·38	—	0·44	35·5	—	,,	100–50			
		20	—	−1·20	33·99	27·37	2·38	—	0·44	36·4	7·76	,,	250–100			
		30	—	−1·20	33·99	27·37	2·38	—	0·45	31·3?	—	,,	500–250			
		40	—	−1·20	33·99	27·37	2·38	—	0·39	39·0	7·74	,,	750–500			
		50	—	−1·20	33·99	27·37	2·38	—	0·36	40·4	—	,,	1000–750			
		60	—	−1·20	33·99	27·37	2·45	—	0·39	43·6	7·74	**NHP**	50–0	—	**2205**	
		80	—	−1·20	33·99	27·37	2·45	—	0·42	46·8	—	**CWS**	0			
		100	—	−1·20	33·99	27·37	2·45	—	0·38	47·7	7·72	,,	5			
		150	—	−1·19	33·99	27·37	2·45	—	0·37	51·7	7·70	,,	10			
		200	—	−0·88	34·05	27·40	2·59	—	0·34	57·7	7·44	,,	20			
		300	—	0·41	34·45	27·66	3·06	—	0·00	62·9	5·22	,,	50			
		400	—	0·83	34·59	27·75	3·17	—	0·00	66·7	4·68	,,	100			
		600[1]	596	1·14	34·69	27·80	3·08	—	—	76·3	4·34	**NH**	0	**2100**		
		800[1]	—	1·02	34·70	27·83	2·89	—	—	82·8	4·40	**N 70 B**	133–0	**0132**	**0152**	KT
		1000[1]	—	0·89	34·70	27·84	2·85	—	—	90·3	4·44	**N 100 B**				
		1500[2]	1506	0·47	34·69	27·84	2·89	—	—	91·6	4·42	**N 100 H**	0–5	**0132**	**0154**	
		2000[2]	—	0·26	34·69	27·86	2·91	—	—	93·6	4·59					
		2500[2]	2504	0·10	34·69	27·86	2·98	—	—	99·1	4·65					
		3000[2]	2998	−0·04	34·69	27·87	3·00	—	—	103·6	4·83					
		3500[3]	3507	−0·22	34·68	27·88	2·91	—	—	105·4	4·77					
		4000[3]	4012	−0·28	34·68	27·89	2·83	—	—	106·9	4·76					
		4500[3]	—	−0·27	34·67	27·87	2·74	—	—	105·1	4·86					
		5000[3]	—	−0·28	34·67	27·88	2·70	—	—	104·9	4·76					
1389	8	0	—	0·24	34·01	27·32	—	—	0·41	20·1	7·48	**N 50 V**	100–0	**2015**		
		5	—	0·24	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·25	34·01	27·32	—	—	0·41	21·3	—	,,	100–50			
		20	—	0·25	34·01	27·32	—	—	0·40	22·4	7·49	,,	250–100			
		30	—	0·25	34·01	27·32	—	—	0·40	22·4	—	,,	500–250			
		40	—	0·25	34·01	27·32	—	—	0·40	22·7	7·48	,,	750–500			
		50	—	0·25	34·01	27·32	—	—	0·38	22·6	—	,,	1000–750			
		60	—	0·25	34·01	27·32	—	—	0·37	22·5	7·68	**NHP**	50–0	—	**2200**	
		80	—	0·25	34·01	27·32	—	—	0·39	22·8	—	**CWS**	0			
		100	—	0·25	34·01	27·32	—	—	0·39	23·7	7·47	,,	5			
		150	—	0·30	34·01	27·31	—	—	0·37	23·5	7·41	,,	10			
		200	—	1·61	34·30	27·46	—	—	0·00	42·4	5·10	,,	20			
		295	—	1·85	34·43	27·55	—	—	0·00	49·9	4·41	,,	50			
		395[1]	—	2·02	34·51	27·60	—	—	0·00	56·2	4·07	,,	100			
		590[1]	—	2·09	34·64	27·70	—	—	—	59·3	3·93	**N 70 B**	164–0	**2324**	**2344**	KT
		790[2]	782	2·11	34·70	27·75	—	—	—	64·4	3·85	**N 100 B**				
		980[2]	—	1·90	34·72	27·78	—	—	—	68·4	4·05	**N 100 H**	0–5	**2324**	**2345**	
		1470[2]	—	1·47	34·71	27·81	—	—	—	70·9	4·33					
		1960[2]	1966	0·91	34·70	27·84	—	—	—	89·3	4·47					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1389 *cont.*	53° 38·4′ S, 20° 58′ W	1934 18 viii											
1390	51° 30·5′ S, 22° 14·6′ W	19 viii	2000	4407*	N × W	14	N × W	3	od	978·3	1·8	1·8	mod. conf. NNW swell
1391	47° 34·2′ S, 23° 48·8′ W	21 viii	0900	4451*	NW × N	19	NW × N	4	oqr	997·2	3·6	3·3	mod. NW × N swell
1392	51° 25·3′ S, 29° 24·1′ W	23 viii	2200	3539*	S	16	S	3	c	983·6	−0·6	−0·9	mod. SW swell
1393	52° 55·9′ S, 31° 54·6′ W	24 viii	2200	3546*	Lt airs	1–3	—	1	c	1004·6	−5·3	−5·5	low SW swell
1394	54° 23·5′ S, 34° 08·9′ W	25 viii	1042	4065*	NE × E	15	NE × E	3	os	979·5	−1·4	−1·4	mod. NE swell
			1654	—	NE	19	NE	4	os	974·0	−1·1	−1·1	mod. NE swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS					Mg.—atom m.³					BIOLOGICAL OBSERVATIONS		TIME		Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
1389 *cont.*	8	2490^3	2487	0·54	34·69	27·84	—	—	—	99·6	4·43					
		2990^3	—	0·25	34·69	27·86	—	—	—	103·7	4·54					
		3490^3	—	0·03	34·69	27·87	—	—	—	112·7	4·82					
		3990^3	3987	−0·11	34·69	27·88	—	—	—	113·2	4·97					
1390	9	0	—	1·03	33·95	27·22	1·79	—	0·43	19·2	7·41	**N 50 V**	100–0	**2014**		
		5	—	1·03	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	1·03	33·95	27·22	1·82	—	0·44	19·2	—	,,	100–50			
		20	—	1·03	33·95	27·22	1·84	—	0·44	20·1	7·45	,,	250–100			
		30	—	1·03	33·95	27·22	1·86	—	0·43	19·5	—	,,	500–250			
		40	—	1·03	33·95	27·22	1·90	—	0·44	20·3	7·40	,,	750–500			
		50	—	1·03	33·95	27·22	1·90	—	0·44	19·2	—	,,	1000–750			
		60	—	1·03	33·95	27·22	1·92	—	0·40	19·6	7·41	**NHP**	50–0	—	**2141**	
		80	—	1·03	33·96	27·23	1·90	—	0·42	19·7	—	**CWS**	0			
		100	—	1·03	33·96	27·23	1·90	—	0·39	19·7	7·40	,,	5			
		150	—	1·08	33·96	27·23	1·94	—	0·41	20·0	7·37	,,	10			
		200	—	1·17	34·11	27·34	2·43	—	0·00	28·9	6·27	,,	20			
		295	—	1·78	34·37	27·51	2·85	—	0·00	45·1	4·75	,,	50			
		395^1	—	1·94	34·46	27·56	2·85	—	0·00	53·8	4·33	,,	100			
		590^1	—	2·19	34·59	27·65	2·85	—	—	59·8	3·92	**N 70 B**	} 178–0	**2325**	**2345**	KT
		790^2	789	2·21	34·65	27·69	2·85	—	—	66·3	3·86	**N 100 B**				
		990^2	—	2·11	34·72	27·76	2·79	—	—	69·4	3·94	**N 100 H**	0–5	**2325**	**2345**	
		1480^2	—	1·90	34·75	27·81	2·47	—	—	76·7	4·34					
		1970^2	—	1·29	34·74	27·84	2·60	—	—	86·4	4·31					
		2500^3	—	0·79	34·71	27·85	2·74	—	—	89·4	4·34					
		2990^3	—	0·42	34·70	27·87	2·74	—	—	94·7	4·56					
		3490^3	—	0·16	34·69	27·86	2·78	—	—	103·5	4·74					
		3990^3	3992	−0·01	—	—	2·74	—	—	113·3	4·79					
1391	11	0	—	2·70	34·03	27·17	1·65	—	0·34	10·4	7·14	**N 50 V**	100–0	0925		
		5	—	2·70	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	2·70	34·03	27·17	1·73	—	0·35	10·6	—	,,	100–50			
		20	—	2·70	34·03	27·17	1·73	—	0·34	10·9	7·16	,,	250–100			
		30	—	2·70	34·03	27·17	1·75	—	0·36	11·5	—	,,	500–250			
		40	—	2·70	34·03	27·17	1·84	—	0·34	12·0	7·16	,,	750–500			
		50	—	2·70	34·03	27·17	1·84	—	0·34	12·0	—	,,	1000–750			
		60	—	2·70	34·03	27·17	1·84	—	0·34	12·0	7·13	**NHP**	50–0	—	1107	
		80	—	2·70	34·03	27·17	1·84	—	0·34	11·8	—	**CWS**	0			
		95	—	2·69	34·03	27·17	1·84	—	0·33	12·4	7·13	,,	5			
		145	—	2·80	34·05	27·17	1·84	—	0·31	12·4	7·07	,,	10			
		195	—	2·76	34·13	27·23	2·09	—	0·00	15·5	6·51	,,	20			
		290	—	2·26	34·17	27·31	2·32	—	0·00	24·8	5·84	,,	50			
		385	—	2·57	34·32	27·40	2·68	—	0·00	32·9	5·01	,,	100			
		580	—	2·47	34·43	27·50	2·78	—	—	43·8	4·33	**N 70 B**	} 126–0	1230	1250	KT
		770^1	768	2·39	34·54	27·60	2·97	—	—	49·6	3·87	**N 100 B**				
		960^1	—	2·39	34·63	27·67	2·78	—	—	56·0	3·96					
		1440^1	—	1·94	34·70	27·76	2·78	—	—	70·9	3·92					
		1930^1	1928	1·98	34·76	27·80	2·43	—	—	55·6	4·54					
		2420^2	2422	1·29	34·75	27·85	2·59	—	—	55·1	4·29					
		2900^2	—	0·87	34·71	27·85	2·74	—	—	74·0	4·50					
		3390^2	—	0·44	34·70	27·87	2·74	—	—	77·0	4·63					
		3870^2	3869	0·24	34·68	27·86	2·79	—	—	88·8	4·64					
1392	14	0	—	−0·70	33·95	27·31	—	—	—	—	—	**N 50 V**	100–0	**2207**	—	+2 hours
												NHP	50–0	—	**2218**	
												N 70 B	} 140–0	**2225**	**2245**	Depth estimated
												N 100 B				
1393	14	0	—	−0·60	34·12	27·45	—	—	—	—	—	**N 50 V**	100–0	**2200**		
												NHP	50–0	—	**2215**	
												N 70 B	} 140–0	**2222**	**2242**	KT
												N 100 B				
1394	15	0	—	−1·10	34·06	27·42	2·43	—	—	40·5	7·67	**N 70 B**	} 86–0	1119	1139	KT
		5	—	−1·10	—	—	—	—	—	—	—	**N 100 B**				
		10	—	−1·10	34·06	27·42	2·43	—	—	40·5	—	**N 70 B**	} 230–110	1119	1150	DGP
		20	—	−1·10	34·06	27·42	2·43	—	—	40·5	7·68	**N 100 B**				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1394 *cont.*	54° 23·5′ S, 34° 08·9′ W	1934 25 viii											
1395	54° 23·5′ S, 34° 43·9′ W	25 viii	1918	2352*	ENE	14	ENE	3	os	972·6	−0·2	−0·4	mod. NE swell
1396	54° 23·5′ S, 35° 17·7′ W	26 viii	0001	368*	SSE	9	SE	3	os	973·6	−0·9	−0·9	mod. NE swell
1397	54° 23·5′ S, 35° 54·2′ W	26 viii	0352	159*	NW	5	NW	2	c	973·9	−0·6	−0·9	conf. low NE and mod. NW swells

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	Mg.—atom m.³ P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	BIOLOGICAL OBSERVATIONS Gear	Depth (metres)	TIME From	To	Remarks
1394 *cont.*	15	30	—	−1·10	34·06	27·42	2·51	—	—	41·9	—	**N 50 V**	100–0	1219		
		40	—	−1·10	34·06	27·42	2·51	—	—	41·9	7·66	**N 70 V**	50–0			
		50	—	−1·10	34·06	27·42	2·57	—	—	42·4	—	,,	100–50			
		60	—	−1·10	34·06	27·42	2·62	—	—	42·6	7·63	,,	250–100			
		80	—	−1·09	34·06	27·42	2·62	—	—	41·6	—	,,	500–250			
		100	—	−1·00	34·06	27·41	2·64	—	—	42·4	7·53	,,	750–500			
		145	—	−0·06	34·22	27·49	2·76	—	—	50·1	6·27	,,	1000–750			
		190	—	1·11	34·43	27·60	3·00	—	—	55·1	4·92	**NHP**	50–0	—	1344	
		290	—	1·64	34·56	27·67	3·06	—	—	60·2	4·22	**CWS**	0			
		385	—	1·90	34·64	27·72	3·08	—	—	67·9	3·98	,,	5			
		580	—	1·72	34·70	27·78	2·98	—	—	68·0	4·15	,,	10			
		770[1]	778	1·51	34·73	27·82	2·98	—	—	72·3	4·10	,,	20			
		960[1]	—	1·38	34·74	27·84	2·98	—	—	79·5	4·20	,,	50			
		1440[1]	—	0·91	34·71	27·85	2·98	—	—	85·6	4·46	,,	100			
		1920[1]	1906	0·53	34·70	27·86	2·98	—	—	92·3	4·53					
		2450[2]	2410	0·29	34·69	27·85	2·98	—	—	95·1	4·52					
		2940[2]	—	0·10	34·69	27·86	2·98	—	—	97·8	4·75					
		3430[2]	—	0·01	34·69	27·87	3·02	—	—	97·1	4·97					
		3820[2]	3863	−0·09	34·69	27·88	3·02	—	—	94·9	4·93					
1395	15	0	—	−0·69	33·99	27·35	2·45	—	—	32·2	7·56	**N 70 B**	179–0	**1929**	**1949**	KT
		5	—	−0·69	—	—	—	—	—	—	—	**N 100 B**				
		10	—	−0·69	33·99	27·35	2·45	—	—	32·8	—	**N 50 V**	100–0	**2005**		
		20	—	−0·69	33·99	27·35	2·45	—	—	33·0	7·58	**N 70 V**	50–0			
		30	—	−0·69	33·99	27·35	2·45	—	—	31·6	—	,,	100–50			
		40	—	−0·69	33·99	27·35	2·45	—	—	32·7	7·60	,,	250–100			
		50	—	−0·69	33·99	27·35	2·45	—	—	33·2	—	,,	500–250			
		60	—	−0·69	33·99	27·35	2·45	—	—	34·2	7·51	,,	750–500			
		80	—	−0·66	33·99	27·35	2·45	—	—	34·2	—	,,	1000–750			
		100	—	−0·59	33·99	27·35	2·49	—	—	34·2	7·41	**NHP**	50–0	—	**2121**	
		150	—	1·72	34·33	27·47	2·81	—	—	42·4	4·99	**CWS**	0			
		195	—	2·03	34·42	27·52	2·93	—	—	47·9	4·42	,,	5			
		295	—	2·14	34·53	27·61	2·93	—	—	57·2	3·97	,,	10			
		390	—	2·15	34·60	27·66	2·93	—	—	58·6	3·90	,,	20			
		590[1]	587	2·03	34·67	27·73	2·93	—	—	66·1	3·66	,,	50			
		780[1]	—	1·85	34·72	27·78	2·72	—	—	69·6	3·47	,,	100			
		960[2]	—	1·78	34·72	27·79	2·79	—	—	70·0	3·92					
		1440[2]	—	1·19	34·70	27·82	2·79	—	—	83·3	4·29					
		1920[2]	1919	0·83	34·70	27·84	2·81	—	—	91·3	4·35					
1396	16	0	—	−0·30	33·99	27·34	2·28	—	—	28·8	7·46	**N 70 B**	146–0	**0010**	**0030**	KT
		5	—	−0·30	—	—	—	—	—	—	—	**N 100 B**				
		10	—	−0·30	33·99	27·34	2·30	—	—	28·9	—	**N 50 V**	100–0	**0047**		
		20	—	−0·30	33·99	27·34	2·34	—	—	28·3	7·45	**N 70 V**	50–0			
		30	—	−0·30	33·99	27·34	2·34	—	—	29·7	—	,,	100–50			
		40	—	−0·30	33·99	27·34	2·41	—	—	29·3	7·45	,,	250–100			
		50	—	−0·30	33·99	27·34	2·43	—	—	29·7	—	**NHP**	50–0	—	**0117**	
		60	—	−0·30	33·99	27·34	2·51	—	—	30·3	7·43	**CWS**	0			
		80	—	−0·30	34·00	27·34	2·51	—	—	30·1	—	,,	5			
		100	—	−0·29	34·02	27·35	2·51	—	—	33·6	7·39	,,	10			
		150	—	0·12	34·10	27·39	2·53	—	—	37·9	6·83	,,	20			
		200	—	1·49	34·34	27·51	2·87	—	—	45·3	4·90	,,	50			
		300	—	1·79	34·45	27·57	2·87	—	—	51·1	4·43	,,	100			
1397	16	0	—	−0·45	33·88	27·25	2·41	—	—	30·1	7·47	**N 70 B**	152–0	**0402**	**0422**	KT
		5	—	−0·42	—	—	—	—	—	—	—	**N 100 B**				
		10	—	−0·41	33·88	27·25	2·43	—	—	29·9	—	**N 50 V**	100–0	**0435**		
		20	—	−0·30	33·95	27·29	2·43	—	—	29·6	7·48	**N 70 V**	50–0			
		30	—	−0·30	33·95	27·29	2·43	—	—	29·5	—	,,	100–50			
		40	—	−0·28	33·95	27·29	2·47	—	—	29·5	7·45	**NHP**	50–0	—	**0455**	
		50	—	−0·27	33·95	27·29	2·47	—	—	31·2	—	**CWS**	0			
		60	—	−0·26	33·95	27·29	2·47	—	—	34·2	7·23	,,	5			
		80	—	−0·20	33·99	27·33	2·47	—	—	34·7	—	,,	10			
		100	—	−0·18	33·99	27·33	2·47	—	—	34·2	—	,,	20			
												,,	50			
												,,	100			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1398	3 miles S 60° E of Jason I, South Georgia	1934 30 viii	0755	—	NNE	14	NNE	2	b	1001·2	−1·1	−1·9	low ENE swell
1399	53° 39·9′ S, 37° 06·4′ W	1 ix	1225	196*	WNW	9	WNW	2	os	977·1	0·3	0·3	mod. NW swell
1400	53° 19′ S, 37° 05·9′ W	1 ix	1652	2335*	W × N	9	W × N	2	om	979·0	−0·2	−0·2	mod. NW swell
1401	52° 58·7′ S, 37° 05·5′ W	2 ix	0001	2337*	SW	2	—	1	c	984·9	−0·5	−0·6	mod. conf. WNW swell
1402	52° 36·3′ S, 37° 04·9′ W	2 ix	0540	2070*	SW	9	SW	2	c	987·5	0·3	0·0	mod. conf. W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom $m.^3$							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1398	20	0	—	−0·60	33·72	27·13	—	—	—	—	—	**N 50 V**	100–0	0755	0801	+2 hours 30 minutes
1399	22	0	—	−0·36	33·93	27·28	2·24	—	—	27·4	7·47	**N 70 B**	134–0	1230	1250	KT. +3 hours
		5	—	−0·39	—	—	—	—	—	—	—	**N 100 B**				
		10	—	−0·39	33·93	27·28	2·24	—	—	27·8	—	**N 50 V**	100–0	1300		
		20	—	−0·39	33·93	27·28	2·24	—	—	28·4	7·48	**N 70 V**	50–0			
		30	—	−0·39	33·93	27·28	2·24	—	—	29·6	—	,,	100–50			
		40	—	−0·40	33·93	27·28	2·24	—	—	29·7	7·46	**NHP**	50–0	—	1321	
		50	—	−0·40	33·96	27·31	2·19	—	—	30·0	—	**CWS**	0			
		60	—	−0·35	34·01	27·35	2·22	—	—	28·2	7·46	,,	5			
		80	—	−0·35	34·02	27·36	2·28	—	—	28·8	—	,,	10			
		100	—	−0·25	34·02	27·35	2·13	—	—	29·9	7·23	,,	20			
		150	—	0·90	34·22	27·44	2·51	—	—	40·9	5·53	,,	50			
												,,	100			
1400	22	0	—	−0·39	33·99	27·34	2·26	—	—	30·1	7·54	**N 70 B**	155–0	1659	1719	KT
		5	—	−0·39	—	—	—	—	—	—	—	**N 100 B**				
		10	—	−0·39	33·99	27·34	2·26	—	—	29·9	—	**N 50 V**	100–0	1736		
		20	—	−0·39	33·99	27·34	2·26	—	—	29·7	7·54	**N 70 V**	50–0			
		30	—	−0·39	33·99	27·34	2·26	—	—	30·2	—	,,	100–50			
		40	—	−0·39	33·99	27·34	2·26	—	—	29·6	7·53	,,	250–100			
		50	—	−0·39	33·99	27·34	2·30	—	—	29·2	—	,,	500–250			
		60	—	−0·39	33·99	27·34	2·30	—	—	29·6	7·46	,,	750–500			
		80	—	−0·36	33·99	27·34	2·40	—	—	29·0	—	,,	1000–750			
		95	—	−0·29	34·04	27·36	2·26	—	—	31·0	7·38	**NHP**	50–0	—	1924	
		145	—	−0·02	34·08	27·39	2·30	—	—	31·2	7·13	**CWS**	0			
		190	—	1·19	34·31	27·50	2·66	—	—	42·1	5·09	,,	5			
		290	—	2·00	34·52	27·61	2·79	—	—	52·7	4·03	,,	10			
		385	—	2·04	34·60	27·67	2·83	—	—	55·8	3·93	,,	20			
		580[1]	—	2·02	34·63	27·70	2·72	—	—	59·4	3·69	,,	50			
		770[1]	—	1·94	34·68	27·74	2·62	—	—	62·6	3·65	,,	100			
		960[1]	—	1·83	34·70	27·77	2·60	—	—	66·6	3·83					
		1450[1]	—	1·42	34·70	27·80	2·60	—	—	77·5	4·15					
		1930[1]	1928	1·02	34·69	27·81	2·60	—	—	80·8	4·44					
1401	23	0	—	−0·30	34·01	27·35	2·26	—	—	31·0	7·44	**N 70 B**	141–0	0015	0035	KT
		5	—	−0·30	—	—	—	—	—	—	—	**N 100 B**				
		10	—	−0·31	34·01	27·35	2·26	—	—	31·4	—	**N 50 V**	100–0	0053		
		20	—	−0·32	34·01	27·35	2·26	—	—	31·0	7·42	**N 70 V**	50–0			
		30	—	−0·32	34·01	27·35	2·26	—	—	30·9	—	,,	100–50			
		40	—	−0·34	34·01	27·35	2·19	—	—	31·0	7·41	,,	250–100			
		50	—	−0·35	34·01	27·35	2·22	—	—	31·0	—	,,	500–250			
		60	—	−0·35	34·01	27·35	2·26	—	—	30·8	7·41	,,	750–500			
		80	—	−0·37	34·04	27·37	2·26	—	—	30·5	—	,,	1000–800			
		100	—	−0·37	34·04	27·37	2·15	—	—	31·0	7·37	**NHP**	50–0	—	0222	
		145	—	0·60	34·16	27·42	2·36	—	—	36·8	6·02	**CWS**	0			
		190	—	1·76	34·42	27·54	2·64	—	—	46·3	4·44	,,	5			
		290	—	1·97	34·52	27·61	2·70	—	—	56·9	4·02	,,	10			
		385	—	2·04	34·60	27·67	2·59	—	—	56·8	3·86	,,	20			
		580[1]	582	1·95	34·67	27·73	2·59	—	—	63·2	3·83	,,	50			
		770[1]	—	1·79	34·69	27·75	2·59	—	—	65·5	3·88	,,	100			
		960[1]	—	1·64	34·70	27·79	2·60	—	—	72·3	3·86					
		1440[1]	—	1·15	34·69	27·80	2·60	—	—	81·7	4·18					
		1920[1]	1915	0·82	34·69	27·82	2·60	—	—	97·2	4·45					
1402	23	0	—	−0·43	34·02	27·36	2·24	—	—	27·5	7·37	**N 70 B**	93–0	0617	0637	KT
		5	—	−0·44	—	—	—	—	—	—	—	**N 100 B**				DGP. **N 100 B** fished
		10	—	−0·45	34·02	27·36	2·28	—	—	32·1	—	**N 70 B**	290–160	0617	0647	for few minutes on
		20	—	−0·46	34·02	27·36	2·28	—	—	34·0	7·39	**N 100 B**				surface
		30	—	−0·46	34·02	27·36	2·28	—	—	34·4	—	**N 50 V**	100–0	0708		
		40	—	−0·46	34·02	27·36	2·28	—	—	35·0	7·37	**N 70 V**	50–0			
		50	—	−0·46	34·02	27·36	2·28	—	—	35·0	—	,,	100–50			
		60	—	−0·46	34·02	27·36	2·28	—	—	35·2	7·36	,,	250–100			
		80	—	−0·46	34·02	27·36	2·32	—	—	35·6	—	,,	500–250			
		100	—	−0·44	34·02	27·36	2·34	—	—	33·9	7·29	,,	750–500			
		150	—	1·16	34·30	27·49	2·64	—	—	47·1	5·16	,,	1000–750			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1402 *cont.*	52° 36·3′ S, 37° 04·9′ W	1934 2 ix											
1403	53° 59·3′ S, 38° 46·6′ W	2–3 ix	2249	236*	E	8	E	3	o	986·2	−1·1	−1·7	low E swell
1404	53° 59·8′ S, 39° 27·9′ W	3 ix	0530	433*	SE	8	SE	2	c	999·5	−0·7	−1·2	low SE swell
1405	54° 00·1′ S, 40° 07·4′ W	3 ix	0915	2740*	SE	5	SE	2	c	1001·8	0·0	−0·5	low SE swell
1406	54° 00·3′ S, 40° 46·9′ W	3 ix	1326	2579*	S	12	S	2	csp	1002·7	0·1	−0·3	low S × E swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1402 *cont.*	23	200	—	1·83	34·43	27·55	2·81	—	—	50·0	4·36	**NHP**	50–0	—	0858	
		300	—	1·95	34·56	27·64	2·70	—	—	58·0	3·96	**CWS**	0			
		400	—	1·98	34·60	27·67	2·70	—	—	61·6	3·90	,,	5			
		600[1]	549?	1·87	34·65	27·72	2·60	—	—	70·3	3·82	,,	10			
		800[1]	—	1·73	34·71	27·79	2·60	—	—	74·6	3·84	,,	20			
		1000[1]	—	1·52	34·70	27·80	2·60	—	—	78·5	3·94	,,	50			
		1500[1]	—	1·05	34·69	27·81	2·60	—	—	79·3	4·36	,,	100			
1403	23	0	—	−0·01	33·98	27·31	2·47	—	—	30·1	7·51	**N 70 B** **N 100 B**	104–0	**2256**	**2316**	KT
		5	—	−0·01	—	—	—	—	—	—	—					
		10	—	−0·01	33·98	27·31	2·47	—	—	30·5	—	**N 50 V**	100–0	**2326**		
		20	—	−0·01	33·98	27·31	2·47	—	—	32·5	7·10	**N 70 V**	50–0			
		30	—	−0·01	33·98	27·31	2·47	—	—	32·6	—	,,	100–50			
		40	—	−0·01	33·98	27·31	2·47	—	—	32·5	7·45	,,	200–100			
		50	—	−0·01	33·98	27·31	2·36	—	—	32·6	—	**NHP**	50–0	—	**2351**	
		60	—	−0·02	33·98	27·31	2·43	—	—	32·9	7·43	**CWS**	0			
		80	—	−0·04	33·98	27·31	2·47	—	—	33·2	—	,,	5			
		100	—	−0·04	33·99	27·32	2·47	—	—	32·3	7·41	,,	10			
		150	—	0·40	34·08	27·37	2·47	—	—	38·0	6·45	,,	20			
		200	—	0·62	34·13	27·39	2·47	—	—	42·4	6·04	,,	50			
												,,	100			
1404	24	0	—	−0·31	33·95	27·30	2·07	—	—	29·6	7·58	**N 70 B** **N 100 B**	117–0	**0540**	**0600**	KT
		5	—	−0·31	—	—	—	—	—	—	—					
		10	—	−0·31	33·95	27·30	2·19	—	—	30·1	—	**N 50 V**	100–0	0617		
		20	—	−0·31	33·95	27·30	2·19	—	—	31·6	7·58	**N 70 V**	50–0			
		30	—	−0·32	33·95	27·30	2·22	—	—	31·3	—	,,	100–50			
		40	—	−0·32	33·95	27·30	2·19	—	—	31·4	7·57	,,	250–100			
		50	—	−0·32	33·95	27·30	2·19	—	—	32·2	—	,,	400–250			
		60	—	−0·32	33·95	27·30	2·20	—	—	31·3	7·56	**NHP**	50–0	—	0652	
		80	—	−0·40	33·95	27·30	2·28	—	—	32·0	—	**CWS**	0			
		100	—	−0·27	34·01	27·34	2·28	—	—	32·0	7·35	,,	5			
		150	—	0·96	34·25	27·46	2·51	—	—	40·9	5·48	,,	10			
		200	—	1·48	34·36	27·52	2·70	—	—	48·2	4·74	,,	20			
		300	—	1·83	34·49	27·59	2·70	—	—	53·1	4·27	,,	50			
		400	—	1·95	34·53	27·62	2·85	—	—	57·9	4·04	,,	100			
1405	24	0	—	−0·01	33·92	27·26	2·15	—	—	24·7	7·42	**N 70 B** **N 100 B**	110–0	0927	0947	KT
		5	—	−0·01	—	—	—	—	—	—	—					
		10	—	−0·01	33·93	27·26	2·17	—	—	25·1	—	**N 50 V**	100–0	0956		
		20	—	−0·01	33·93	27·26	2·17	—	—	25·3	7·43	**N 70 V**	50–0			
		30	—	0·31	33·97	27·28	2·17	—	—	23·4	—	,,	100–50			
		40	—	0·57	33·99	27·29	2·17	—	—	20·9	7·30	,,	250–100			
		50	—	0·57	34·00	27·29	2·17	—	—	19·3	—	,,	500–250			
		60	—	0·59	34·00	27·29	2·17	—	—	19·5	7·30	,,	750–500			
		80	—	0·66	34·00	27·28	2·19	—	—	18·8	—	,,	1000–750			
		100	—	0·62	34·01	27·30	2·19	—	—	18·6	7·27	**NHP**	50–0	—	1114	
		150	—	1·29	34·13	27·34	2·40	—	—	30·8	6·06	**CWS**	0			
		195	—	1·91	34·33	27·46	2·66	—	—	40·5	4·90	,,	5			
		290	—	2·20	34·55	27·62	2·76	—	—	48·6	4·03	,,	10			
		390	—	2·15	34·60	27·66	2·83	—	—	52·9	3·91	,,	20			
		580	—	2·11	34·62	27·69	2·78	—	—	59·4	3·85	,,	50			
		780[1]	719?	2·09	34·66	27·71	2·68	—	—	63·7	3·84	,,	100			
		970[1]	—	1·94	34·68	27·74	2·68	—	—	67·9	3·71					
		1460[1]	—	1·60	34·72	27·80	2·68	—	—	72·2	4·08					
		1950[1]	—	0·94	34·71	27·84	2·68	—	—	89·8	4·38					
		2430[1]	2432	0·79	34·70	27·84	2·70	—	—	92·9	4·36					
1406	24	0	—	0·42	34·00	27·30	2·09	—	—	19·4	7·35	**N 70 B** **N 100 B**	113–0	1346	1406	KT
		5	—	0·42	—	—	—	—	—	—	—					
		10	—	0·41	34·00	27·30	2·09	—	—	20·2	—	**N 70 B** **N 100 B**	320–130	1346	1416	DGP
		20	—	0·41	34·00	27·30	2·09	—	—	20·4	7·33					
		30	—	0·40	34·00	27·30	2·09	—	—	20·4	—	**N 50 V**	100–0	1610		
		40	—	0·39	34·00	27·30	2·09	—	—	20·3	7·35	**N 70 V**	50–0			
		50	—	0·39	34·00	27·30	2·09	—	—	20·4	—	,,	100–50			
		60	—	0·39	34·00	27·30	2·17	—	—	21·1	7·34	,,	250–100			
		80	—	0·39	34·00	27·30	2·17	—	—	21·3	—	,,	500–250			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1406 *cont.*	54° 00·3′ S, 40° 46·9′ W	1934 3 ix											
1407	55° 51′ S, 44° 47·2′ W	4 ix	2200	3771*	SW	6	SW	2	o	998·5	−3·9	−5·0	low SW swell
1408	57° 19·1′ S, 48° 21·5′ W	5 ix	2200	3555*	S	4–6	S	2	b	1018·5	−4·2	−4·7	low S swell
1409	59° 01·8′ S, 52° 31·2′ W	6 ix	2200	3776*	W	2	—	1	ome	1018·6	−2·0	−2·0	low conf. swell
1410	59° 26·3′ S, 55° 25·2′ W	7 ix	2222	3650*	NNW	22	NNW	4	o	995·4	0·6	0·6	mod. conf. NNW and NW swells
1411	60° 51·5′ S, 58° 38·7′ W	8 ix	2200	4583*	NW	10	NW	3	bc	989·5	−0·6	−0·6	mod. NW swell
1412	62° 00·9′ S, 62° 47·3′ W	9 ix	2200	4089*	N	1–2	—	1	b	986·0	−1·1	−1·1	mod. NW swell
1413	62° 52·9′ S, 67° 33·7′ W	10 ix	2200	3703*	N × E	20	N × E	4	os	973·1	−0·6	−0·6	mod. conf. N swell
1414	63° 47·4′ S, 72° 34·8′ W	11 ix	2200	3784*	S × W	24	S × W	4	sfg	969·2	−3·4	−3·7	mod. conf. WNW swell
1415	63° 40·6′ S, 78° 03·5′ W	12 ix	2000	3976*	SW × S	10	SW × S	2	os	975·6	−3·3	−3·7	low conf. W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom $m.^3$							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1406 *cont.*	24	100	—	0·39	34·02	27·32	2·17	—	—	21·0	7·34	**N 70 V**	700–500			
		150	—	0·61	34·07	27·35	2·19	—	—	22·4	6·89	**NHP**	50–0	—	1704	
		195	—	1·30	34·21	27·41	2·53	—	—	34·2	5·58	**CWS**	0			
		290	—	1·73	34·40	27·53	2·81	—	—	44·7	4·62	,,	5			
		390	—	1·93	34·50	27·60	2·81	—	—	50·0	4·18	,,	10			
		590	—	1·96	34·60	27·67	2·81	—	—	55·5	3·92	,,	20			
		780[1]	—	2·02	34·63	27·70	2·81	—	—	62·3	3·82	,,	50			
		980[1]	—	1·92	34·69	27·74	2·74	—	—	69·7	3·74	,,	100			
		1460[1]	—	1·48	34·72	27·81	2·74	—	—	78·7	4·12					
		1950[1]	—	1·05	34·71	27·84	2·74	—	—	84·0	4·21					
		2440[1]	2439	0·67	34·70	27·85	2·78	—	—	94·3	4·62					
1407	25	0	—	2·10	34·08	27·25	—	—	—	—	—	**N 50 V**	100–0	**2207**		
												NHP	50–0	—	**2218**	
												N 70 B	173–0	**2225**	**2245**	KT
												N 100 B				
1408	27	0	—	−0·75	33·93	27·29	—	—	—	—	—	**N 50 V**	100–0	**2212**		
												NHP	50–0	—	**2220**	
												N 70 B	160–0	**2225**	**2245**	KT
												N 100 B				
1409	28	0	—	−1·40	34·08	27·45	—	—	—	—	—	**N 50 V**	100–0	**2204**		
												NHP	50–0	—	**2214**	
												N 70 B	128–0	**2220**	**2240**	KT
												N 100 B				
1410	29	0	—	−1·55	34·05	27·42	—	—	—	—	—	**N 50 V**	100–0	**2228**		
												NHP	50–0	—	**2238**	
												N 100 B	173–0	**2251**	**2311**	KT
1411	29	0	—	−1·70	34·00	27·38	—	—	—	—	—	**N 50 V**	100–0	**2210**		
												NHP	50–0	—	**2220**	
												N 70 B	154–0	**2226**	**2246**	KT
												N 100 B				
												N 100 H	0–5	**2223**	**2250**	
1412	1	0	—	−1·60	34·01	27·39	—	—	—	—	—	**N 50 V**	100–0	**2201**	—	+4 hours
												NHP	50–0	—	**2210**	
												N 70 B	148–0	**2218**	**2238**	KT
												N 100 B				
												N 100 H	0–5	**2218**	**2222**	
1413	2	0	—	−1·45	34·00	27·38	—	—	—	—	—	**N 50 V**	100–0	**2208**		
												NHP	50–0	—	**2218**	
												N 70 B	146–0	**2227**	**2247**	KT. **N 100 B** fished at 5 metres for 3 minutes extra
												N 100 B				
1414	3	0	—	−1·70	33·96	27·35	—	—	—	—	—	**N 100 B**	156–0	**2212**	**2233**	KT
1415	4	0	—	−1·09	33·87	27·27	2·00	36·41	0·25	18·9	7·63	**N 50 V**	100–0	**2010**	—	+5 hours
		5	—	−1·10	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·10	33·87	27·27	2·00	—	0·26	18·6	—	,,	100–50			
		20	—	−1·09	33·87	27·27	2·07	31·41	0·26	18·6	7·61	,,	250–100			
		30	—	−1·09	33·87	27·27	2·00	—	0·26	21·3	—	,,	500–250			
		40	—	−1·09	33·87	27·27	2·00	35·70	0·26	20·4	7·61	,,	750–500			
		50	—	−1·09	33·87	27·27	2·01	—	0·26	20·4	—	,,	1000–750			
		60	—	−1·09	33·87	27·27	2·01	31·41	0·26	20·4	7·61	,,	1500–1000			
		80	—	−1·00	33·89	27·27	2·01	32·13	0·26	20·4	—	**NHP**	50–0	—	**2208**	
		100	—	−0·92	33·90	27·28	2·03	36·41	0·25	20·7	7·51	**CWS**	0			
		150	—	−0·49	33·94	27·29	2·05	33·55	0·24	20·2	7·30	,,	5			
		200	—	0·72	34·11	27·37	2·09	34·27	0·00	29·2	6·45	,,	10			
		295	—	1·77	34·26	27·42	2·41	—	0·00	39·2	5·13	,,	20			
		390	—	2·06	34·38	27·50	2·64	35·70	0·00	46·3	4·47	,,	50			
		590[1]	588	2·33	34·55	27·61	2·64	35·70	—	54·1	3·76	,,	100			
		780[1]	—	2·20	34·62	27·68	2·64	44·26	—	69·3	3·72	**N 70 B**	80–0	**2306**	**2326**	KT
		980[1]	948?	2·17	34·69	27·72	2·70	44·98	—	71·2	3·66	**N 100 B**				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1415 *cont.*	63° 40·6′ S, 78° 03·5′ W	1934 12 ix											
1416	62° 31·5′ S, 78° 18·3′ W	13 ix	0900	4574*	SW × S	14	SW × S	4	csp	983·7	−3·3	−3·9	mod. SW swell
1417	61° 05·2′ S, 78° 34·2′ W	13–14 ix	2000	4887*	SSW	24	SSW	4	o	998·2	−2·3	−2·8	mod. conf. SW swell
			0000	—	SW × S	24	SW × S	4	c	1000·9	−1·7	−2·3	mod. conf. SW swell
1418	59° 50·5′ S, 78° 34·3′ W	14 ix	0900	4834*	SW	9	SW	3	csp	1007·1	0·3	0·1	mod. SW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S °/₀₀	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
1415 *cont.*	4	1490^2	1436?	1·88	34·74	27·80	2·53	35·70	—	78·1	3·81	**N 70 B**	290–180	**2306**	**2336**	DGP
		1990^2	—	1·50	34·74	27·83	2·66	—	—	86·8	4·05	**N 100 B**				
		2490^2	2476	1·17	34·72	27·83	2·55	36·41	—	91·2	4·13	**N 100 H**	0–5	**2307**	**2337**	
		2990^2	—	0·84	34·71	27·85	2·55	—	—	101·5	4·38					
		3490^2	3501	0·55	34·71	27·87	2·55	35·70	—	108·2	4·42					
1416	4	0	—	−0·38	33·92	27·28	2·03	—	0·19	18·9	7·43	**N 50 V**	100–0	0909		
		5	—	−0·30	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·29	33·93	27·27	1·90	—	0·20	19·6	—	,,	100–50			
		20	—	−0·29	33·94	27·28	1·88	—	0·19	20·0	7·43	,,	250–100			
		30	—	−0·21	33·94	27·28	1·88	—	0·19	19·9	—	,,	500–250			
		40	—	−0·20	33·94	27·28	1·86	—	0·15	20·2	7·42	,,	750–500			
		50	—	0·09	33·95	27·28	1·86	—	0·14	20·3	—	,,	1000–750			
		60	—	0·00	33·95	27·28	1·86	—	0·15	20·8	7·27	**NHP**	50–0	—	1028	
		80	—	0·09	33·95	27·28	1·88	—	0·15	20·4	—	**CWS**	0			
		100	—	0·01	33·95	27·28	1·86	—	0·15	20·2	7·28	,,	5			
		150	—	0·12	33·96	27·28	1·84	—	0·13	20·7	7·23	,,	10			
		200	—	0·24	33·97	27·29	1·81	—	0·11	20·1	7·17	,,	20			
		300	—	1·53	34·17	27·37	2·03	—	0·00	30·8	5·88	,,	50			
		400	—	2·04	34·29	27·42	2·26	—	0·00	42·3	5·05	,,	100			
		600^1	548?	2·41	34·43	27·51	2·26	—	—	51·1	3·94	**N 70 B**	77–0	1105	1125	KT
		800^1	—	2·32	34·55	27·61	2·28	—	—	63·4	3·49	**N 100 B**				
		1000^1	—	2·21	34·63	27·68	2·28	—	—	67·3	3·67	**N 70 B**	260–130	1105	1135	DGP. **N 100 B** did not close and was torn
		1500^1	—	2·02	34·73	27·78	2·26	—	—	72·4	3·66	**N 100 B**	260–0			
		2000^1	1999	1·69	34·74	27·81	2·26	—	—	84·3	4·00					
1417	5	0	—	1·82	34·04	27·24	1·84	42·12	<0·04	14·3	6·97	**N 50 V**	100–0	**2205**		
		5	—	1·82	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	1·82	34·04	27·24	1·82	—	<0·04	14·5	—	,,	100–50			
		20	—	1·83	34·04	27·23	1·79	43·55	<0·04	14·8	6·98	,,	250–100			
		30	—	1·85	34·04	27·23	1·84	—	<0·04	14·9	—	,,	500–250			
		40	—	1·85	34·04	27·23	1·84	42·12	<0·04	14·9	6·96	,,	750–500			
		50	—	1·81	34·04	27·24	1·86	—	<0·04	14·9	—	,,	1000–750			
		60	—	1·83	34·04	27·23	1·86	42·83	<0·04	14·7	6·96	**NHP**	50–0	—	**2340**	
		80	—	1·82	34·04	27·24	1·86	42·83	<0·04	15·0	—	**CWS**	0			
		100	—	1·79	34·04	27·24	1·86	42·12	<0·04	14·9	6·92	,,	5			
		150	—	1·77	34·04	27·24	1·81	42·83	<0·04	15·0	6·93	,,	10			
		190	—	1·74	34·04	27·24	1·84	43·55	<0·04	14·9	6·94	,,	20			
		290	—	1·59	34·04	27·25	1·82	—	0·00	15·7	6·92	,,	50			
		385	—	1·54	34·05	27·27	1·81	42·83	0·00	17·4	6·71	,,	100			
		570^1	573	2·69	34·32	27·39	2·26	43·55	—	36·4	4·56	**N 100 B**	104–0	**0005**	**0025**	KT
		770^1	—	2·55	34·45	27·50	2·43	46·40	—	46·2	4·03	**N 70 B**	370–150	**0005**	**0035**	DGP
		960^1	—	2·46	34·55	27·60	2·51	48·55	—	55·4	3·62	**N 100 B**				
		1440^1	—	2·21	34·70	27·74	2·59	43·55	—	65·8	3·78					
		1920^1	1919	1·87	34·74	27·80	2·43	—	—	72·1	3·89					
		2480^2	—	1·55	34·74	27·82	2·49	42·83	—	79·8	4·03					
		2970^2	—	1·20	34·74	27·85	2·49	—	—	91·0	4·15					
		3470^2	—	0·93	34·74	27·87	2·49	42·12	—	101·4	4·10					
		3960^2	3965	0·62	34·73	27·88	2·49	—	—	111·7	4·22					
1418	5	0	—	2·46	34·07	27·22	1·73	—	<0·04	13·8	6·80	**N 50 V**	100–0	0907		
		5	—	2·47	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	2·47	34·07	27·21	1·73	—	<0·04	13·9	—	,,	100–50			
		20	—	2·47	34·07	27·21	1·73	—	<0·04	13·5	6·79	,,	250–100			
		30	—	2·47	34·07	27·21	1·79	—	<0·04	13·6	—	,,	500–250			
		40	—	2·45	34·07	27·22	1·81	—	<0·04	13·8	6·78	,,	750–500			
		50	—	2·44	34·07	27·22	1·82	—	<0·04	13·6	—	,,	1000–750			
		60	—	2·44	34·07	27·22	1·82	—	<0·04	13·7	6·77	**NHP**	50–0	—	1032	
		80	—	2·44	34·07	27·22	1·82	—	<0·04	14·0	—	**CWS**	0			
		100	—	2·41	34·07	27·22	1·82	—	<0·04	14·3	6·80	,,	5			
		150	—	2·40	34·07	27·22	1·86	—	<0·04	14·8	6·80	,,	10			
		200	—	2·37	34·07	27·22	1·88	—	<0·04	15·1	6·78	,,	20			
		300	—	2·12	34·04	27·21	1·88	—	0·00	16·7	6·77	,,	50			
		400	—	2·66	34·15	27·27	2·03	—	0·00	23·7	5·82	,,	100			
		600^1	—	2·79	34·29	27·36	2·34	—	—	35·6	4·79	**N 70 B**	95–0	1050	1110	KT
		800^1	—	2·70	34·43	27·48	2·66	—	—	47·7	4·03	**N 100 B**				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1418 *cont.*	59° 50·5′ S, 78° 34·3′ W	1934 14 ix											
1419	58° 23·6′ S, 78° 25′ W	14–15 ix	2000	4938*	W	10	W	2	or	1009·7	3·3	3·3	low conf. W swell
			0000	—	W	12	W	3	or	1009·7	3·3	2·8	mod. conf. W swell
1420	56° 53′ S, 78° 13·8′ W	15 ix	0900	4827*	SW	14	SW	3	c	1017·6	3·6	3·4	mod. SW swell
1421	55° 22·2′ S, 78° 10·9′ W	15 ix	2000	4374*	SW	6	SW	2	odm	1024·0	3·9	3·9	low conf. SW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.^{3}							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N$_2$	Nitrite N$_2$	Si	O$_2$ c.c. litre	Gear	Depth (metres)	From	To	
1418 *cont.*	5	1000^1	—	2·52	34·54	27·59	2·55	—	—	59·0	3·87	**N 70 B**	370–190	1050	1120	DGP
		1500^1	—	2·22	34·65	27·69	2·57	—	—	67·2	3·68	**N 100 B**				
		2000^1	1998	1·95	34·74	27·79	2·47	—	—	72·9	3·84					
1419	6	0	—	2·86	34·11	27·21	1·79	—	<0·04	13·3	6·83	**N 50 V**	100–0	**2010**		
		5	—	2·86	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	2·86	34·11	27·21	1·79	—	<0·04	13·6	—	,,	100–50			
		20	—	2·85	34·11	27·21	1·79	—	<0·04	12·9	6·85	,,	250–100			
		30	—	2·85	34·11	27·21	1·79	—	<0·04	12·8	—	,,	500–250			
		40	—	2·85	34·11	27·21	1·79	—	<0·04	12·8	6·84	,,	750–500			
		50	—	2·85	34·11	27·21	1·79	—	<0·04	12·9	—	,,	1000–750			
		60	—	2·85	34·11	27·21	1·81	—	<0·04	13·0	6·81	,,	1500–1000			
		80	—	2·85	34·11	27·21	1·84	—	<0·04	12·9	—	**NHP**	50–0	—	**2214**	
		100	—	2·86	34·11	27·21	1·81	—	<0·04	12·7	6·78	**CWS**	0			
		150	—	2·88	34·11	27·21	1·81	—	<0·04	12·8	6·76	,,	5			
		200	—	2·90	34·11	27·21	1·79	—	<0·04	12·8	6·75	,,	10			
		300	—	2·89	34·11	27·21	1·81	—	<0·04	13·2	6·72	,,	20			
		400	—	2·86	34·12	27·22	1·92	—	0·00	23·7	6·09	,,	50			
		600^1	548?	3·23	34·28	27·32	2·24	—	—	31·7	4·77	,,	100			
		800^1	—	2·89	34·37	27·42	2·59	—	—	44·8	4·30	**N 70 B**	100–0	**2333**	**2353**	KT
		1000^1	—	2·63	34·46	27·51	2·66	—	—	49·3	4·02	**N 100 B**				
		1500^1	—	2·28	34·65	27·69	2·60	—	—	58·1	3·77	**N 70 B**	350–240	**2333**	**0007**	DGP
		2000^1	2000	2·03	34·72	27·77	2·60	—	—	67·6	3·80	**N 100 B**				
		2500^2	2500	1·70	34·74	27·81	2·55	—	—	72·6	4·00					
		2990^2	—	1·38	34·74	27·84	2·55	—	—	80·5	4·14					
		3490^2	—	1·03	34·73	27·85	2·49	—	—	87·3	4·32					
		3990^2	—	0·66	34·72	27·86	2·51	—	—	104·2	4·27					
		4490^2	4485	0·57	34·72	27·87	2·51	—	—	109·4	4·37					
1420	6	0	—	4·11	34·21	27·17	1·56	—	0·00	10·2	6·65	**N 50 V**	100–0	0911		
		5	—	4·11	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	4·11	34·21	27·17	1·54	—	0·00	10·3	—	,,	100–50			
		20	—	4·11	34·21	27·17	1·56	—	0·00	10·5	6·66	,,	250–100			
		30	—	4·11	34·21	27·17	1·62	—	0·00	10·4	—	,,	500–250			
		40	—	4·11	34·21	27·17	1·65	—	0·00	10·6	6·66	,,	750–500			
		50	—	4·11	34·21	27·17	1·65	—	0·00	10·7	—	,,	1000–750			
		60	—	4·11	34·21	27·17	1·67	—	0·00	10·3	6·59	**NHP**	50–0	—	1037	
		80	—	4·11	34·21	27·17	1·63	—	0·00	10·4	—	**CWS**	0			
		100	—	4·11	34·21	27·17	1·65	—	0·00	10·5	6·58	,,	5			
		150	—	4·11	34·21	27·17	1·63	—	0·00	10·6	6·59	,,	10			
		200	—	4·11	34·21	27·17	1·63	—	0·00	10·7	6·56	,,	20			
		300	—	4·04	34·21	27·18	1·65	—	0·00	10·7	6·59	,,	50			
		400	—	4·04	34·21	27·18	1·63	—	0·00	11·2	6·56	,,	100			
		600^1	595	3·85	34·21	27·20	1·94	—	—	18·8	5·59	**N 70 B**	84–0	1051	1111	KT
		800^1	—	3·54	34·30	27·30	2·26	—	—	27·6	4·85	**N 100 B**				
		1000^1	—	3·15	34·37	27·39	2·53	—	—	41·4	4·33	**N 70 B**	270–170	1051	1121	DGP
		1500^1	—	2·42	34·56	27·60	2·64	—	—	59·4	3·64	**N 100 B**				
		2000^1	1997	2·19	34·67	27·71	2·41	—	—	71·4	3·77					
1421	7	0	—	4·94	34·12	27·01	1·35	27·13	0·09	0·0	6·60	**N 50 V**	100–0	**2012**		
		5	—	4·94	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	4·94	34·12	27·01	1·35	—	0·09	0·0	—	,,	100–50			
		20	—	4·94	34·12	27·01	1·35	25·34	0·09	0·0	6·58	,,	250–100			
		30	—	4·94	34·12	27·01	1·35	—	0·09	0·0	—	,,	500–250			
		40	—	4·94	34·12	27·01	1·35	25·34	0·09	0·0	6·56	,,	750–500			
		50	—	4·94	34·12	27·01	1·35	—	0·09	0·0	—	,,	1000–750			
		60	—	4·94	34·12	27·01	1·35	27·84	0·09	0·0	6·52	,,	1500–1000			
		80	—	4·95	34·14	27·03	1·35	26·41	0·08	0·0	—	**NHP**	50–0	—	**2226**	
		100	—	4·97	34·14	27·03	1·35	21·42	0·08	0·0	6·42	**CWS**	0			
		150	—	4·95	34·23	27·10	1·44	25·34	0·00	0·0	6·04	,,	5			
		200	—	4·69	34·23	27·13	1·43	23·92	0·00	9·0	6·35	,,	10			
		300	—	4·69	34·23	27·13	1·44	—	0·00	10·2	6·27	,,	20			
		400	—	4·59	34·23	27·14	1·44	27·13	0·00	10·6	6·33	,,	50			
		600^1	600	4·55	34·23	27·14	1·54	28·56	—	12·8	6·02	,,	100			
		800^1	—	4·06	34·23	27·19	1·81	34·27	—	18·6	5·55	**N 70 B**	82–0	**2308**	**2328**	KT
		1000^1	—	3·61	34·32	27·31	2·34	38·91	—	27·5	4·42	**N 100 B**				
		1500^1	1511	2·72	34·50	27·53	2·53	44·62	—	55·8	3·41	**N 70 B**	290–170	**2308**	**2338**	DGP
		1970^2	1973	2·31	34·66	27·69	2·49	—	—	65·0	3·56	**N 100 B**				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1421 *cont.*	55° 22·2′ S, 78° 10·9′ W	1934 15 ix											
1422	52° 29·4′ S, 64° 03·8′ W	20 ix	2200	260*	NW	9	NW	2	b	1015·3	6·5	5·6	mod. N × W swell
1423	53° 52·8′ S, 56° 51·6′ W	25 ix	0900	1612*	WSW	14	WSW	4	c	1024·9	4·0	2·7	mod. SW × S swell
1424	55° 09·3′ S, 56° 15·6′ W	25 ix	2000	3497*	W	5	W	2	oe	1022·0	3·9	2·8	low W swell
1425	56° 36·3′ S, 55° 25′ W	26 ix	0900	4150*	NW	9	NW	2	ce	1017·7	2·5	1·7	low WSW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.^{3}							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1421 *cont.*	7	2460^2	—	2·01	34·70	27·76	2·47	41·76	—	70·9	3·67					
		2960^2	—	1·74	34·74	27·81	2·43	—	—	81·3	3·98					
		3450^2	—	1·42	34·74	27·83	2·43	39·98	—	83·6	4·03					
		3940^2	3939	0·98	34·73	27·85	2·43	—	—	90·8	4·23					
1422	11	0	—	5·60	34·25	27·03	—	—	—	—	—	**N 50 V**	100–0	**2207**	—	+4 hours
												NHP	50–0	—	**2216**	
												N 70 B	110–0	**2225**	**2245**	KT
												N 100 B				
1423	16	0	—	4·23	34·16	27·12	1·56	—	0·11	9·0	6·68	**N 50 V**	100–0	0909		
		5	—	4·23	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	4·23	34·16	27·12	1·60	—	0·10	9·0	—	,,	100–50			
		20	—	4·23	34·16	27·12	1·58	—	0·10	9·1	6·68	,,	250–100			
		30	—	4·23	34·16	27·12	1·58	—	0·10	9·1	—	,,	500–250			
		40	—	4·23	34·16	27·12	1·58	—	0·10	8·3	6·68	,,	750–500			
		50	—	4·23	34·16	27·12	1·58	—	0·09	9·0	—	,,	1000–750			
		60	—	4·22	34·16	27·12	1·58	—	0·09	9·3	6·64	**NHP**	50–0	—	1031	
		80	—	4·22	34·16	27·12	1·58	—	0·09	9·3	—	**CWS**	0			
		100	—	4·22	34·16	27·12	1·60	—	0·11	9·4	6·56	,,	5			
		150	—	4·19	34·16	27·12	1·58	—	0·13	10·8	6·50	,,	10			
		200	—	4·18	34·16	27·12	1·63	—	0·14	11·6	6·50	,,	20			
		300	—	4·16	34·17	27·13	1·65	—	0·00	11·7	6·35	,,	50			
		400	—	4·02	34·20	27·17	1·63	—	0·00	11·7	6·25	,,	100			
		600^1	547	3·74	34·17	27·18	1·84	—	—	12·2	6·10	**N 70 B**	114–0	1048	1108	KT
		790^1	—	3·45	34·18	27·22	2·05	—	—	18·7	5·78	**N 100 B**				
		990^1	—	3·27	34·21	27·25	2·40	—	—	22·8	5·36	**N 70 B**	430–200	1048	1118	DGP
		1490^1	1489	2·60	34·47	27·52	2·87	—	—	52·9	3·72	**N 100 B**				
1424	17	0	—	4·46	34·13	27·06	1·56	—	0·08	10·0	6·65	**N 50 V**	100–0	**2013**		
		5	—	4·46	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	4·48	34·13	27·06	1·58	—	0·08	10·1	—	,,	100–50			
		20	—	4·48	34·13	27·06	1·58	—	0·07	10·1	6·64	,,	250–100			
		30	—	4·48	34·13	27·06	1·58	—	0·07	10·3	—	,,	500–250			
		40	—	4·47	34·13	27·06	1·56	—	0·06	10·6	6·66	,,	750–500			
		50	—	4·46	34·13	27·06	1·56	—	0·06	10·7	—	,,	1000–750			
		60	—	4·44	34·13	27·06	1·63	—	0·06	10·3	6·55	,,	1500–1000			
		80	—	4·43	34·13	27·07	1·65	—	0·06	10·2	—	**NHP**	50–0	—	**2211**	
		100	—	4·43	34·13	27·07	1·62	—	0·06	10·5	6·50	**CWS**	0			
		150	—	4·41	34·17	27·11	1·69	—	0·04	10·6	6·38	,,	5			
		195	—	4·35	34·18	27·12	1·67	—	0·04	10·2	6·45	,,	10			
		290	—	4·25	34·21	27·15	1·63	—	<0·04	10·2	6·37	,,	20			
		390	—	3·97	34·19	27·17	1·71	—	0·00	11·7	6·33	,,	50			
		580^1	—	3·66	34·14	27·17	1·77	—	—	15·8	6·17	,,	100			
		780^1	777	3·08	34·15	27·23	2·22	—	—	21·9	5·70	**N 70 B**	110–0	**2232**	**2252**	KT
		980^2	980	3·00	34·26	27·32	2·60	—	—	33·1	4·74	**N 100 B**				
		1480^2	—	2·51	34·55	27·60	2·93	—	—	60·5	3·64	**N 70 B**	450–200	**2232**	**2302**	DGP
		1970^2	—	2·17	34·67	27·71	2·81	—	—	70·5	3·52	**N 100 B**				
		2460^2	—	1·91	34·72	27·78	2·81	—	—	78·9	3·73					
		2950^2	2956	1·57	34·73	27·81	2·74	—	—	90·2	4·00					
1425	17	0	—	1·62	34·04	27·25	1·86	—	0·11	15·3	7·03	**N 50 V**	100–0	0908		
		5	—	1·62	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	1·62	34·04	27·25	1·86	—	0·11	15·1	—	,,	100–50			
		20	—	1·55	34·04	27·26	1·86	—	0·11	15·6	7·00	,,	250–100			
		30	—	1·54	34·04	27·26	1·86	—	0·11	15·5	—	,,	500–250			
		40	—	1·53	34·04	27·26	1·86	—	0·11	15·9	7·01	,,	750–500			
		50	—	1·53	34·04	27·26	1·90	—	0·11	16·0	—	,,	1000–750			
		60	—	1·53	34·04	27·26	1·90	—	0·10	16·2	7·00	**NHP**	50–0	—	1039	
		80	—	1·53	34·04	27·26	1·90	—	0·10	16·0	—	**CWS**	0			
		95	—	1·52	34·04	27·26	1·90	—	0·10	16·2	6·98	,,	5			
		145	—	1·52	34·04	27·26	1·88	—	0·09	16·1	6·95	,,	10			
		190	—	1·37	34·04	27·27	1·84	—	0·10	17·6	6·91	,,	20			
		290	—	1·72	34·10	27·29	2·11	—	0·00	25·4	6·04	,,	50			
		380	—	2·12	34·22	27·35	2·28	—	0·00	33·0	5·21	,,	100			
		570^1	575	2·49	34·39	27·47	2·59	—	—	47·6	4·22	**N 70 B**	104–0	1059	1119	KT
		770^1	—	2·38	34·51	27·57	2·66	—	—	58·6	3·75	**N 100 B**				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. °C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1425 *cont.*	56° 36·3′ S, 55° 25′ W	1934 26 ix											
1426	57° 47·6′ S, 54° 52·2′ W	26 ix	2000	4237*	WNW	9	WNW	2	ofe	1009·4	0·8	0·6	low W swell
1427	58° 56·1′ S, 54° 30·4′ W	27 ix	0900	3826*	W	24	W	5	cme	1005·3	0·0	−0·5	mod. W swell
1428	59° 51′ S, 54° 08·8′ W	27 ix	2000	3462*	WSW	30	WSW	5	c	999·8	0·0	−1·1	heavy W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	Mg.—atom m.^{3}				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1425 *cont.*	17	960^1	—	2·25	34·59	27·65	2·81	—	—	64·4	3·62	**N 70 B**	420–200	1059	1129	DGP
		1440^1	—	2·04	34·68	27·74	2·57	—	—	72·1	3·65	**N 100 B**				
		1920^1	1859?	1·68	34·72	27·79	2·57	—	—	77·9	3·87					
1426	18	0	—	−1·21	33·86	27·25	2·11	—	0·21	20·3	7·69	**N 50 V**	100–0	**2057**		
		5	—	−1·21	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·21	33·86	27·25	1·90	—	0·23	20·6	—	,,	100–50			
		20	—	−1·21	33·86	27·25	1·96	—	0·22	20·7	7·70	,,	250–100			
		30	—	−1·24	33·86	27·25	1·98	—	0·23	20·7	—	,,	500–250			
		40	—	−1·27	33·86	27·25	1·98	—	0·22	21·4	7·68	,,	750–500			
		50	—	−1·27	33·86	27·25	1·98	—	0·24	21·2	—	,,	1000–750			
		60	—	−1·28	33·86	27·25	2·00	—	0·22	21·3	7·64	**NHP**	50–0	—	**2223**	
		80	—	−1·38	33·86	27·25	2·05	—	0·21	21·2	—	**CWS**	0			
		100	—	−1·34	33·87	27·27	2·05	—	0·19	21·9	7·41	,,	5			
		150	—	0·11	34·07	27·37	2·36	—	0·06	27·1	6·34	,,	10			
		200	—	1·12	34·22	27·42	2·40	—	0·00	36·5	5·31	,,	20			
		300	—	1·22	34·36	27·54	2·43	—	0·00	45·7	4·72	,,	50			
		400	—	1·74	34·48	27·60	2·45	—	0·00	53·2	4·11	,,	100			
		600^1	596	2·06	34·59	27·66	2·45	—	—	59·4	3·75	**N 70 B**	100–0	**2306**	**2326**	KT
		800^1	—	2·07	34·69	27·73	2·49	—	—	65·8	3·73	**N 100 B**				
		1000^1	—	1·98	34·72	27·77	2·55	—	—	69·1	3·77	**N 70 B**	380–200	**2306**	**2336**	DGP
		1500^1	1509	1·61	34·73	27·81	2·38	—	—	77·9	3·96	**N 100 B**				
		2000^2	—	1·16	34·70	27·82	2·59	—	—	86·3	4·13	**N 100 H**	0–5	**2309**	**2336**	
		2500^2	—	0·83	34·69	27·82	2·59	—	—	98·8	4·26					
		3000^2	—	0·41	34·68	27·85	2·57	—	—	105·0	4·45					
		3500^2	—	0·26	34·68	27·86	2·60	—	—	108·1	4·74					
		4000^2	3994	0·10	34·66	27·84	2·60	—	—	107·9	4·94					
1427	18	0	—	−1·40	33·94	27·33	2·15	—	0·23	22·2	7·69	**N 50 V**	100–0	0918		
		5	—	−1·40	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·40	33·94	27·33	2·15	—	0·23	24·7	—	,,	100–50			
		20	—	−1·40	33·94	27·33	2·15	—	0·23	26·0	7·68	,,	250–100			
		30	—	−1·40	33·94	27·33	2·17	—	0·23	27·5	—	,,	500–250			
		40	—	−1·40	33·94	27·33	2·24	—	0·23	28·5	7·67	,,	750–500			
		50	—	−1·40	33·94	27·33	2·24	—	0·23	29·7	—	,,	1000–750			
		60	—	−1·40	33·94	27·33	2·26	—	0·23	31·9	7·58	**NHP**	50–0	—	1039	
		80	—	−1·55	33·98	27·37	2·36	—	0·21	34·2	—	**CWS**	0			
		100	—	−1·60	34·03	27·41	2·36	—	0·19	36·9	7·25	,,	5			
		150	—	0·35	34·19	27·46	2·62	—	0·00	45·3	5·33	,,	10			
		200	—	1·49	34·43	27·58	2·62	—	0·00	50·6	4·25	,,	20			
		300	—	1·43	34·52	27·65	2·68	—	0·00	43·8	4·15	,,	50			
		400	—	1·38	34·54	27·68	2·64	—	0·00	53·8	4·14	,,	100			
		600^1	649?	1·76	34·67	27·75	2·59	—	—	60·5	3·78	**N 100 B**	100–0	1057	1117	KT
		800^1	—	1·75	34·71	27·79	2·60	—	—	63·7	3·88	**N 70 B**	430–220	1057	1127	DGP. **N 100 B** probably closed prematurely
		1000^1	—	1·63	34·72	27·80	2·60	—	—	69·2	3·88	**N 100 B**				
		1500^1	—	1·20	34·71	27·83	2·40	—	—	77·3	4·21					
		1990^1	1989	0·88	34·70	27·84	2·51	—	—	85·2	4·37					
1428	19	0	—	−1·35	33·95	27·33	2·38	—	0·22	23·6	7·82	**N 50 V**	100–0	**2016**		
		5	—	−1·35	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·35	33·95	27·33	2·26	—	0·22	28·0	—	,,	100–50			
		20	—	−1·35	33·95	27·33	2·26	—	0·22	28·2	7·71	,,	250–100			
		30	—	−1·35	33·95	27·33	2·28	—	0·22	30·0	—	,,	500–250			
		40	—	−1·35	33·95	27·33	2·28	—	0·22	30·2	7·70	,,	750–500			
		50	—	−1·35	33·95	27·33	2·34	—	0·21	32·1	—	,,	1000–750			
		60	—	−1·35	33·96	27·34	2·36	—	0·21	32·2	7·63	**NHP**	50–0	—	**2156**	
		80	—	−1·35	33·96	27·34	2·40	—	0·21	31·7	—	**CWS**	0			
		95	—	−0·59	34·11	27·44	2·51	—	0·11	32·1	6·47	,,	5			
		145	—	0·55	34·32	27·55	2·74	—	0·00	45·5	5·18	,,	10			
		190	—	1·37	34·48	27·63	2·78	—	0·00	51·8	4·38	,,	20			
		285	—	1·43	34·59	27·71	2·74	—	0·00	55·5	4·16	,,	50			
		380	—	1·94	34·69	27·74	2·72	—	0·00	60·5	3·89	,,	100			
		570^1	571	1·86	34·72	27·78	2·72	—	—	74·1	3·94	**N 100 B**	146–0	**2216**	**2236**	Depth estimated
		760^1	—	1·68	34·74	27·81	2·74	—	—	70·9	3·90	**N 100 B**	520–0	**2216**	**2251**	DGP
		950^1	—	1·47	34·73	27·82	2·59	—	—	59·4	4·03					
		1430^1	—	1·01	34·70	27·83	2·66	—	—	63·4	4·14					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1429	57° 28·6′ S, 45° 56·3′ W	1934 30 ix	2000	3475*	NW × W	18	NW × N	3	ome	991·4	1·1	1·1	mod. conf. W swell
1430	56° 32·7′ S, 45° 50·8′ W	1 x	0900	4122*	NW × W	14	NW × W	4	cm	999·9	0·1	0·1	mod. NW × W swell
1431	55° 46·6′ S, 45° 45·6′ W	1 x	2200	3813*	NW	17	NW	4	od	995·0	2·2	2·2	mod. conf. NW swell
1432	54° 55′ S, 45° 39·6′ W	2 x	0900	3394*	NW	19	NW	4	ome	993·4	2·2	2·1	mod. NW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1429	22	0	—	−0·42	33·93	27·28	2·11	—	0·23	20·6	7·53	**N 50 V**	100–0	**2022**	—	+3 hours
		5	—	−0·42	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·42	33·94	27·29	2·11	—	0·25	22·0	—	,,	100–50			
		20	—	−0·42	33·94	27·29	2·11	—	0·24	24·2	7·53	,,	250–100			
		30	—	−0·42	33·94	27·29	2·11	—	0·24	24·9	—	,,	500–250			
		40	—	−0·42	33·95	27·30	2·05	—	0·23	25·0	7·52	,,	750–500			
		50	—	−0·42	33·95	27·30	2·05	—	0·24	24·8	—	,,	1000–750			
		60	—	−0·42	33·95	27·30	2·05	—	0·24	24·9	7·51	**NHP**	50–0	—	**2154**	
		80	—	−0·42	33·95	27·30	2·05	—	0·24	23·9	—	**CWS**	0			
		100	—	−0·39	33·96	27·31	2·05	—	0·21	24·0	7·43	,,	5			
		150	—	1·60	34·23	27·41	2·34	—	0·00	34·1	5·42	,,	10			
		200	—	1·93	34·32	27·46	2·47	—	0·00	41·0	4·85	,,	20			
		300	—	2·18	34·48	27·57	2·60	—	0·00	46·9	4·08	,,	50			
		400	—	2·17	34·58	27·65	2·68	—	0·00	53·1	3·88	,,	100			
		600^1	598	2·11	34·66	27·71	2·64	—	—	61·8	3·76	,,	300			
		800^1	—	1·97	34·71	27·77	2·66	—	—	67·6	3·81	**N 70 B**	93–0	**2304**	**2324**	KT
		990^2	—	1·78	34·73	27·80	2·57	—	—	72·7	3·72	**N 100 B**				
		1490^2	—	1·19	34·71	27·83	2·57	—	—	86·4	4·14	**N 70 B**	390–180	**2304**	**2334**	DGP
		1980^2	—	0·81	34·70	27·84	2·57	—	—	91·6	4·41	**N 100 B**				
		2480^2	—	0·45	34·70	27·87	2·62	—	—	98·3	4·47	**N 100 H**	0–5	**2304**	**2334**	
		2970^2	2973	0·15	34·69	27·86	2·62	—	—	100·5	4·76					
1430	22	0	—	−0·79	33·90	27·28	2·11	—	0·29	21·8	7·73	**N 50 V**	100–0	0910		
		5	—	−0·80	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·81	33·90	27·28	2·11	—	0·31	21·6	—	,,	100–50			
		20	—	−0·81	33·90	27·28	2·09	—	0·30	21·5	7·72	,,	250–100			
		30	—	−0·81	33·90	27·28	2·19	—	0·30	21·6	—	,,	500–250			
		40	—	−0·82	33·90	27·28	2·19	—	0·30	22·3	7·72	,,	750–500			
		50	—	−0·83	33·90	27·28	2·20	—	0·30	25·6	—	,,	1000–750			
		60	—	−0·83	33·90	27·28	2·20	—	0·30	24·8	7·66	**NHP**	50–0	—	1041	
		80	—	−0·83	33·90	27·28	2·20	—	0·31	25·6	—	**CWS**	0			
		100	—	−0·85	33·90	27·28	2·20	—	0·29	25·6	7·65	,,	5			
		150	—	0·01	34·12	27·42	2·47	—	0·00	35·0	6·35	,,	10			
		200	—	1·39	34·33	27·50	2·64	—	0·00	46·3	4·96	,,	20			
		300	—	1·95	34·49	27·58	2·70	—	0·00	52·9	4·11	,,	50			
		400	—	1·97	34·54	27·63	2·74	—	0·00	57·0	3·96	,,	100			
		600^1	594	2·06	34·64	27·70	2·70	—	—	61·8	3·68	**N 70 B**	91–0	1054	1114	KT
		800^1	—	2·02	34·68	27·74	2·55	—	—	70·3	3·76	**N 100 B**				
		1000^1	—	1·91	34·72	27·78	2·51	—	—	74·0	3·84	**N 70 B**	330–210	1054	1124	Depths estimated
		1500^1	—	1·52	34·73	27·82	2·57	—	—	81·7	3·91	**N 100 B**				
		2000^1	2005	1·03	34·73	27·85	2·59	—	—	88·0	4·21					
1431	23	0	—	1·92	34·07	27·26	—	—	—	—	—	**N 50 V**	100–0	**2203**		
												NHP	50–0	—	**2214**	
												N 70 B	118–0	**2218**	**2238**	KT
												N 100 B				
1432	23	0	—	0·81	33·99	27·27	2·09	—	0·24	18·0	7·44	**N 50 V**	100–0	0908		
		5	—	0·81	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·81	33·99	27·27	2·09	—	0·24	17·8	—	,,	100–50			
		20	—	0·82	33·99	27·27	2·03	—	0·23	18·5	7·42	,,	250–100			
		30	—	0·82	33·99	27·27	2·09	—	0·23	18·6	—	,,	500–250			
		40	—	0·84	33·99	27·27	2·13	—	0·23	18·6	7·37	,,	750–500			
		50	—	0·84	33·99	27·27	2·13	—	0·23	18·9	—	,,	1000–750			
		60	—	1·01	34·04	27·29	2·13	—	0·21	19·0	7·29	**NHP**	50–0	—	1031	
		80	—	1·08	34·04	27·29	2·13	—	0·21	19·5	—	**CWS**	0			
		100	—	1·08	34·04	27·29	2·15	—	0·21	19·8	7·22	,,	5			
		150	—	1·08	34·04	27·29	2·15	—	0·21	19·8	7·08	,,	10			
		200	—	1·71	34·17	27·35	2·38	—	0·00	28·6	5·88	,,	20			
		300	—	2·25	34·33	27·43	2·51	—	0·00	37·6	4·82	,,	50			
		400	—	2·44	34·42	27·48	2·60	—	0·00	43·2	4·26	,,	100			
		600^1	597	2·31	34·53	27·59	2·74	—	—	55·4	3·80					
		800^1	—	2·21	34·61	27·67	2·76	—	—	59·0	3·73					
		970^2	960	2·12	34·68	27·73	2·81	—	—	64·7	3·60					
		1450^2	—	1·78	34·73	27·80	2·59	—	—	71·0	3·88					
		1930^2	—	1·40	34·73	27·82	2·64	—	—	79·2	4·26					
		2420^2	—	0·92	34·70	27·84	2·68	—	—	90·6	4·41					
		2900^2	2906	0·55	34·70	27·86	2·68	—	—	96·7	4·54					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1433	54° 00·5′ S, 45° 33·3′ W	1934 2 x	2000	3310*	NW × W	10	NW × W	3	omr	992·8	2·3	2·2	mod. NW swell
1434	52° 16·3′ S, 45° 21·4′ W	3 x	1600	3047*	W × N	10	W × N	3	o	998·1	2·3	2·2	mod. NW × W swell
1435	50° 07·4′ S, 45° 06·7′ W	4 x	0900	2641*	S × W	9	S × W	3	c	1007·5	2·8	2·2	mod. conf. W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.^{3}							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N$_2$	Nitrite N$_2$	Si	O$_2$ c.c. litre	Gear	Depth (metres)	From	To	
1433	24	0	—	0·83	33·98	27·26	2·09	—	0·22	18·3	7·37	**N 50 V**	100–0	**2012**		
		5	—	0·81	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·81	33·98	27·27	2·09	—	0·23	18·3	—	,,	100–50			
		20	—	0·76	33·98	27·27	2·09	—	0·24	19·3	7·40	,,	250–100			
		30	—	0·72	33·98	27·27	2·09	—	0·24	19·1	—	,,	500–250			
		40	—	0·51	33·98	27·28	2·11	—	0·24	19·9	7·48	,,	750–500			
		50	—	0·41	33·98	27·29	2·11	—	0·24	20·1	—	,,	1000–750			
		60	—	0·31	33·98	27·29	2·13	—	0·24	20·3	7·47	**NHP**	50–0	—	**2131**	
		80	—	0·29	33·98	27·29	2·13	—	0·26	20·6	—	**CWS**	0			
		100	—	0·41	33·98	27·29	2·15	—	0·24	20·6	7·37	,,	5			
		150	—	0·28	33·98	27·30	2·17	—	0·24	23·1	7·07	,,	10			
		200	—	1·82	34·19	27·36	2·41	—	0·00	32·2	5·45	,,	20			
		300	—	2·30	34·37	27·47	2·60	—	0·00	40·2	4·48	,,	50			
		400	—	2·31	34·43	27·51	2·70	—	0·00	46·2	4·16	,,	100			
		590^{1}	591	2·17	34·56	27·63	2·74	—	—	56·3	3·83	**N 70 B**	115–0	**2234**	**2254**	KT
		790^{1}	—	2·15	34·64	27·70	2·76	—	—	63·7	3·76	**N 100 B**				
		1000^{2}	993	1·99	34·68	27·74	2·74	—	—	67·7	3·70	**N 70 B**	450–230	**2234**	**2304**	DGP. **N 100 B** fished for a short time at surface
		1500^{2}	—	1·72	34·73	27·80	2·59	—	—	74·6	3·99	**N 100 B**				
		2000^{2}	—	1·28	34·73	27·83	2·64	—	—	82·1	4·30					
		2490^{2}	—	0·79	34·71	27·85	2·68	—	—	90·5	4·44					
		2990^{2}	2997	0·53	34·69	27·84	2·68	—	—	93·5	4·56					
1434	25	0	—	0·97	33·98	27·25	2·15	—	0·28	17·5	7·51	**N 50 V**	100–0	1609		
		5	—	0·97	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·98	33·98	27·25	2·15	—	0·28	17·4	—	,,	100–50			
		20	—	0·93	33·98	27·26	2·15	—	0·27	18·0	7·50	,,	250–100			
		30	—	0·93	33·98	27·26	2·15	—	0·27	18·0	—	,,	500–250			
		40	—	0·91	33·98	27·26	2·17	—	0·25	18·1	7·52	,,	750–500			
		50	—	0·89	33·98	27·26	2·20	—	0·27	18·6	—	,,	1000–750			
		60	—	0·87	33·99	27·27	2·22	—	0·26	19·1	7·48	**NHP**	50–0	—	1727	
		80	—	0·83	33·99	27·27	2·22	—	0·28	18·9	—	**CWS**	0			
		100	—	0·71	33·99	27·28	2·22	—	0·28	19·5	7·34	,,	5			
		150	—	0·71	33·99	27·28	2·22	—	0·28	20·2	7·23	,,	10			
		200	—	1·25	34·14	27·37	2·38	—	0·00	29·8	6·16	,,	20			
		300	—	1·83	34·29	27·43	2·74	—	0·00	40·5	4·93	,,	50			
		395	—	2·19	34·42	27·51	2·76	—	0·00	48·3	4·29	,,	100			
		590^{1}	592	2·26	34·54	27·61	2·76	—	—	58·1	3·80	**N 70 B**	104–0	**1821**	**1841**	KT
		790^{1}	—	2·17	34·63	27·69	2·74	—	—	63·9	3·74	**N 100 B**				
		970^{2}	979	2·05	34·68	27·73	2·74	—	—	68·2	3·64	**N 70 B**	430–230	**1821**	**1851**	DGP
		1460^{2}	—	1·72	34·72	27·79	2·60	—	—	72·6	3·96	**N 100 B**				
		1950^{2}	—	1·22	34·70	27·82	2·66	—	—	80·9	4·32					
		2430^{2}	—	0·66	34·69	27·83	2·68	—	—	86·5	4·51					
		2820^{2}	2817	0·50	34·69	27·84	2·68	—	—	88·7	4·49					
1435	25	0	—	2·62	33·99	27·14	2·05	—	0·28	12·6	7·18	**N 50 V**	100–0	0909		
		5	—	2·61	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	2·61	33·99	27·14	2·07	—	0·28	12·6	—	,,	100–50			
		20	—	2·59	33·99	27·15	2·07	—	0·29	12·9	7·18	,,	250–100			
		30	—	2·59	33·99	27·15	2·07	—	0·29	12·6	—	,,	500–250			
		40	—	2·57	33·99	27·15	2·07	—	0·29	12·8	7·18	,,	750–500			
		50	—	2·51	33·99	27·15	2·11	—	0·29	12·7	—	,,	1000–750			
		60	—	2·48	33·99	27·15	2·11	—	0·28	13·4	7·18	**NHP**	50–0	—	1033	
		80	—	2·41	33·99	27·16	2·11	—	0·28	13·6	—	**CWS**	0			
		100	—	2·33	33·99	27·17	2·15	—	0·27	14·7	7·17	,,	5			
		150	—	2·12	34·00	27·18	2·15	—	0·31	15·0	7·07	,,	10			
		200	—	2·03	34·01	27·20	2·26	—	0·00	15·6	6·74	,,	20			
		250	—	1·93	—	—	—	—	—	—	—	,,	50			
		300	—	2·04	34·16	27·32	2·47	—	0·00	28·5	5·56	,,	100			
		400	—	2·26	34·26	27·38	2·60	—	0·00	35·2	4·97	**N 70 B**	102–0	1124	1144	KT
		600	—	—	—	—	—	—	—	—	—	**N 100 B**				
		800^{1}	799	2·25	(34·42)	(27·50)	2·76	—	—	57·9?	3·76?	**N 70 B**	410–180	1124	1154	DGP
		1000^{1}	—	2·20	(34·52)	(27·59)	2·78?	—	—	—	3·54?	**N 100 B**				
		1500^{1}	—	1·91	34·69	27·75	2·74	—	—	73·8	3·91					
		2000^{1}	—	1·69	34·73	27·80	2·59	—	—	80·6	4·12					
		2500^{1}	2501	1·21	34·70	27·82	2·68	—	—	85·6	4·26					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1436	51° 07·1′ S, 43° 00·9′ W	1934 4 x	2200	1441*	W × N	5	W × N	2	c	1011·0	2·8	2·1	low conf. SW swell
1437	53° 22·3′ S, 38° 03·3′ W	5 x	2200	2526*	W × N	24	W × N	4	om	996·0	1·7	1·6	mod. W swell
1438	53° 12·5′ S, 43° 22·2′ W	10 x	2000	1285*	W	18	W	3	bcsp	1003·0	2·0	1·6	mod. W swell
1439	52° 54·9′ S, 47° 13·2′ W	11 x	2000	2092*	NW × W	25	NW × W	4	bcq	991·8	3·8	3·1	conf. NW swell
1440	52° 19·3′ S, 51° 09′ W	12 x	2000	2871*	W × S	17	W × S	4	bq	1005·1	4·4	3·0	mod. conf. W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1436	26	0	—	2·80	34·05	27·17	—	—	—	—	—	**N 50 V**	100–0	**2204**		
												NHP	50–0	—	**2213**	
												N 70 B **N 100 B**	128–0	**2219**	**2239**	KT
1437	27	0	—	−0·10	34·05	27·37	—	—	—	—	—	**N 50 V**	100–0	**2209**		
												NHP	50–0	—	**2216**	
												N 70 B **N 100 B**	163–0	**2223**	**2243**	KT
1438	2	0	—	0·74	33·98	27·27	2·09	—	0·29	16·3	7·57	**N 50 V**	100–0	**2011**	—	+4 hours
		5	—	0·74	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·74	33·98	27·27	2·09	—	0·29	16·8	—	,,	100–50			
		20	—	0·74	33·98	27·27	2·09	—	0·29	17·0	7·58	,,	250–100			
		30	—	0·72	33·98	27·27	2·09	—	0·29	17·2	—	,,	500–250			
		40	—	0·65	33·98	27·27	2·15	—	0·28	17·6	7·54	,,	750–500			
		50	—	0·59	33·99	27·29	2·15	—	0·28	17·7	—	,,	1000–750			
		60	—	0·58	33·99	27·29	2·15	—	0·28	18·3	7·52	**NHP**	50–0	—	**2132**	
		80	—	0·58	33·99	27·29	2·15	—	0·26	18·9	—	**CWS**	0			
		100	—	0·56	34·01	27·30	2·15	—	0·27	24·3	7·43	,,	5			
		150	—	0·31	34·05	27·34	2·26	—	0·26	26·6	7·05	,,	10			
		195	—	1·02	34·15	27·39	2·40	—	0·06	27·6	6·08	,,	20			
		290	—	1·83	34·37	27·50	2·68	—	0·00	44·7	4·74	,,	50			
		390^1	388	1·94	34·43	27·54	2·68	—	—	45·2	4·37	,,	100			
		580^1	—	2·05	(34·62)	(27·70)	2·68?	—	—	52·9?	3·69?	**N 70 B** **N 100 B**	106–0	**2248**	**2308**	KT
		780^1	—	1·97	34·69	27·74	2·74	—	—	59·7	3·82					
		970^1	—	1·79	34·70	27·77	2·51	—	—	66·5	3·88	**N 70 B** **N 100 B**	440–250	**2248**	**2318**	DGP
1439	3	0	—	0·95	33·98	27·26	1·88	—	0·20	12·8	7·61	**N 50 V**	100–0	**2010**	—	Small tear in **N 50 V** net
		5	—	0·95	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·94	33·98	27·26	1·77?	—	0·20	14·3	—	,,	100–50			
		20	—	0·94	33·98	27·26	1·90	—	0·20	16·2	7·50	,,	250–100			
		30	—	0·93	33·98	27·26	1·90	—	0·19	16·9	—	,,	500–250			
		40	—	0·92	33·98	27·26	1·90	—	0·19	17·0	7·47	,,	750–500			
		50	—	0·92	33·98	27·26	1·90	—	0·20	16·9	—	,,	1000–750			
		60	—	0·92	33·98	27·26	1·90	—	0·19	17·0	7·50	**NHP**	50–0	—	**2144**	
		80	—	0·91	33·98	27·26	1·90	—	0·20	17·3	—	**CWS**	0			
		100	—	0·83	33·98	27·26	1·92	—	0·19	17·5	7·38	,,	5			
		150	—	0·39	33·98	27·29	2·00	—	0·24	20·2	7·39	,,	10			
		200	—	1·50	34·16	27·36	2·07	—	0·00	24·5	5·94	,,	20			
		300	—	2·20	34·34	27·45	2·38	—	0·00	36·5	4·77	,,	50			
		400	—	2·44	34·44	27·51	2·51	—	0·00	40·2	4·16	,,	100			
		600^1	598	2·25	34·55	27·62	2·70	—	—	43·5	3·89	**N 100 B**	124–0	**2201**	**2221**	KT
		800^1	—	2·16	(34·63)	(27·69)	2·62?	—	—	54·1?	3·45?	**N 70 B** **N 100 B**	500–280	**2201**	**2231**	DGP
		1000^1	—	2·08	34·69	27·73	2·62	—	—	56·0	3·61					
		1500^1	—	1·72	34·74	27·81	2·62	—	—	66·0	3·95					
		2000^1	2002	1·32	34·73	27·83	2·53	—	—	70·3	4·18					
1440	4	0	—	3·81	34·15	27·16	1·69	—	0·13	10·7	7·00	**N 70 V**	50–0	**2015**		
		5	—	3·81	—	—	—	—	—	—	—	,,	100–50			
		10	—	3·81	34·15	27·16	1·69	—	0·13	11·2	—	,,	250–100			
		20	—	3·81	34·15	27·16	1·69	—	0·11	11·9	7·02	,,	500–250			
		30	—	3·81	34·15	27·16	1·69	—	0·11	11·9	—	,,	750–500			
		40	—	3·81	34·15	27·16	1·65	—	0·11	12·0	7·00	,,	1000–750			
		50	—	3·81	34·15	27·16	1·73	—	0·12	12·0	—	**NHP**	50–0	—	**2142**	
		60	—	3·76	34·15	27·17	1·73	—	0·11	12·0	7·01	**CWS**	0			
		80	—	3·71	34·15	27·17	1·75	—	0·11	12·7	—	,,	5			
		100	—	3·41	34·15	27·20	1·77	—	0·11	12·9	6·97	,,	10			
		150	—	3·23	34·15	27·22	1·86	—	0·05	12·9	6·69	,,	20			
		200	—	3·06	34·15	27·23	1·82	—	0·17	13·0	6·83	,,	50			
		300	—	2·78	34·15	27·26	1·81	—	0·00	15·3	6·47	,,	100			
		400	—	2·84	34·19	27·28	2·03	—	0·00	25·5	5·82	**N 100 B**	122–0	**2210**	**2230**	KT
		600	—	2·99	34·24	27·31	2·20	—	—	28·5	5·23	**N 70 B** **N 100 B**	500–210	**2210**	**2240**	DGP
		800^1	806	2·60	34·42	27·47	2·55	—	—	48·9	4·24					
		1000^1	—	2·58	34·51	27·55	2·70	—	—	56·0	3·84					
		1500^1	—	2·19	34·61	27·67	2·41	—	—	—	3·41					
		2000^1	—	1·91	34·70	27·77	2·51	—	—	69·6	3·82					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1441	55° 39·3′ S, 78° 37·6′ W	1934 26 x	0900	4587*	NW × W	24	NW × W	6	omd	1007·6	5·9	5·3	heavy conf. NW swell
1442	56° 48·6′ S, 78° 25·8′ W	26 x	2000	4680*	NW × W	26	NW × W	6	omqe	993·6	5·6	5·3	heavy conf. NW swell
1443	57° 48·7′ S, 78° 24·2′ W	27 x	0900	4510*	W × N	14	W × N	4	b	1001·9	4·5	2·5	heavy W × N swell
1444	59° 02·6′ S, 78° 44·8′ W	27 x	2000	4930*	W × N	24	W × N	4	bcq	989·9	4·2	2·5	heavy conf. WNW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1441	18	0	—	4·51	34·22	27·13	1·58	—	0·12	9·5	7·10	**N 70 V**	50–0	0917	—	+5 hours
		5	—	4·51	—	—	—	—	—	—	—	,,	100–50			
		10	—	4·51	34·22	27·13	1·58	—	0·13	9·3	—	,,	250–100			
		20	—	4·51	34·22	27·13	1·58	—	0·13	9·8	7·06	,,	500–250			
		30	—	4·51	34·22	27·13	1·58	—	0·14	9·7	—	,,	750–500			
		40	—	4·51	34·22	27·13	1·58	—	0·13	9·9	6·99	,,	1000–750	—	1052	
		50	—	4·51	34·22	27·13	1·50	—	0·17	9·8	—	**CWS**	0			
		60	—	4·51	34·22	27·13	1·50	—	0·13	9·8	6·93	,,	5			
		80	—	4·51	34·22	27·13	1·46	—	0·13	11·0	—	,,	10			
		100	—	4·51	34·22	27·13	1·25	—	0·11	10·7	7·02	,,	20			
		150	—	4·52	34·23	27·14	1·37	—	0·13	10·6	6·81	,,	50			
		200	—	4·52	34·23	27·14	1·43	—	0·13	10·5	6·60	,,	100			
		300	—	4·41	34·23	27·16	1·48	—	0·00	10·6	6·59	**N 100 B**	115–0	1113	1133	KT
		400	—	4·32	34·23	27·17	1·48	—	0·00	11·4	6·64	**N 100 B**	460–290	1113	1143	DGP
		600[1]	602	4·12	34·23	27·19	1·60	—	—	12·0	6·12					
		800[2]	—	3·71	34·24	27·24	2·03	—	—	20·3	5·59					
1442	18	0	—	4·50	34·22	27·13	1·50	—	0·09	10·0	6·84	**N 50 V**	100–0	**2027**		
		5	—	4·50	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	4·50	34·22	27·13	1·50	—	0·11	10·5	—	,,	100–50			
		20	—	4·50	34·22	27·13	1·50	—	0·10	10·7	6·82	,,	250–100			
		30	—	4·50	34·22	27·13	1·44	—	0·10	10·4	—	,,	500–250			
		40	—	4·50	34·22	27·13	1·46	—	0·10	10·6	6·84	,,	750–500			
		50	—	4·50	34·22	27·13	1·43	—	0·10	10·9	—	,,	1000–750	—	**2201**	
		60	—	4·50	34·22	27·13	1·48	—	0·09	11·3	6·78	**CWS**	0			
		80	—	4·49	34·22	27·13	1·48	—	0·09	10·6	—	,,	5			
		100	—	4·49	34·22	27·13	1·50	—	0·16	11·2	6·79	,,	10			
		150	—	4·49	34·22	27·13	1·50	—	0·11	11·3	6·77	,,	20			
		200	—	4·43	34·22	27·13	1·52	—	0·11	11·9	6·69	,,	50			
		300	—	4·25	34·22	27·15	1·56	—	0·00	12·1	6·49	,,	100			
		400	—	4·17	34·22	27·16	1·58	—	0·00	12·6	6·48	**N 100 B**	155–0	**2208**	**2228**	KT
1443	19	0	—	4·51	34·21	27·13	1·44	—	0·12	8·9	6·84	**N 50 V**	100–0	0915		
		5	—	4·51	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	4·51	34·21	27·13	1·44	—	0·12	9·1	—	,,	100–50			
		20	—	4·51	34·21	27·13	1·48	—	0·12	9·6	6·80	,,	250–100			
		30	—	4·51	34·21	27·13	1·50	—	0·12	9·8	—	,,	500–250			
		40	—	4·51	34·21	27·13	1·48	—	0·11	10·0	6·78	,,	750–500			
		50	—	4·50	34·21	27·13	1·39	—	0·12	10·2	—	,,	1000–750			
		60	—	4·50	34·21	27·13	1·44	—	0·12	10·3	6·77	**NHP**	50–0	—	1041	
		80	—	4·50	34·21	27·13	1·52	—	0·11	10·0	—	**CWS**	0			
		100	—	4·50	34·22	27·13	1·39	—	0·11	10·5	6·75	,,	5			
		150	—	4·48	34·22	27·13	1·48	—	0·11	9·8	6·73	,,	10			
		200	—	4·52	34·22	27·12	1·48	—	0·11	10·8	6·74	,,	20			
		300	—	4·31	34·22	27·15	1·52	—	0·00	11·3	6·55	,,	50			
		400	—	4·20	34·22	27·16	1·52	—	0·00	11·2	6·46	,,	100			
		600[1]	591	3·72	34·17	27·18	1·67	—	—	17·1	6·12	**N 70 B**	142–0	1222	1242	KT
		800[1]	—	3·66	(34·28)	(27·27)	2·11?	—	—	20·4?	4·74?	**N 100 B**				
		1000[1]	—	3·05	34·37	27·40	2·51	—	—	44·3	4·29	**N 70 B**	480–200	1222	1252	DGP
		1500[1]	1503	2·47	34·58	27·62	2·64	—	—	63·6	3·59	**N 100 B**				
		2000[2]	2007	2·14	34·67	27·72	2·55	—	—	68·3	3·69					
		2490[2]	—	1·81	34·72	27·78	2·57	—	—	71·7	3·73					
		2990[2]	—	1·52	34·74	27·83	2·49	—	—	77·9	4·18					
		3490[2]	—	1·17	(34·74)	(27·85)	2·19?	—	—	77·8?	4·05?					
		3990[2]	3978	0·77	34·73	27·87	2·49	—	—	85·0	4·50					
1444	19	0	—	3·55	34·14	27·18	1·44	—	0·13	11·8	6·91	**N 50 V**	100–0	**2019**	—	+6 hours
		5	—	3·55	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	3·55	34·14	27·18	1·46	—	0·13	12·0	—	,,	100–50			
		20	—	3·55	34·14	27·18	1·60	—	0·13	12·2	6·95	,,	250–100			
		30	—	3·55	34·14	27·18	1·56	—	0·14	12·0	—	,,	500–250			
		40	—	3·55	34·14	27·18	1·58	—	0·13	12·2	6·92	,,	750–500			
		50	—	3·55	34·14	27·18	1·67	—	0·14	12·0	—	,,	1000–750			
		60	—	3·55	34·14	27·18	1·69	—	0·12	11·9	6·91	**NHP**	50–0	—	**2153**	
		80	—	3·55	34·14	27·18	1·50	—	0·12	12·1	—	**CWS**	0			
		100	—	3·55	34·14	27·18	1·62	—	0·11	12·6	6·90	,,	5			
		150	—	3·51	34·14	27·18	1·63	—	0·12	12·3	6·87	,,	10			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1444 *cont.*	59° 02·6′ S, 78° 44·8′ W	1934 27 x											
1445	60° 06·7′ S, 79° 17·6′ W	28 x	0900	4960*	WNW	19	WNW	5	omd	987·0	3·9	3·3	heavy WNW swell
1446	61° 15·5′ S, 79° 26·4′ W	28 x	2000	4843*	N	4	NNW	1	cd	977·4	1·4	1·0	mod. WNW swell
1447	62° 37·7′ S, 79° 28·6′ W	29 x	0900	4607*	NW	14	NW	4	c	978·7	1·7	1·2	mod. NW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1444 *cont.*	19	200	—	3·43	34·14	27·19	1·54	—	0·12	12·5	6·84	**CWS**	20			
		300	—	3·42	34·14	27·19	1·62	—	0·13	12·6	6·80	,,	50			
		400	—	2·98	34·13	27·21	1·77	—	0·00	17·7	6·38	,,	100			
		600^1	582	3·43	34·26	27·28	2·32	—	—	25·3	4·90	**N 100 B**	165–0	**2210**	**2230**	Depth estimated
		790^1	—	2·88	34·36	27·41	2·59	—	—	36·5	4·30	**N 100 B**	520–250	**2210**	**2240**	DGP
		990^1	—	2·55	34·43	27·50	2·59	—	—	43·6	4·06					
		1490^1	—	2·30	(34·61)	(27·66)	2·53?	—	—	31·3?	3·55?					
		1990^1	1999	2·00	34·70	27·76	2·55	—	—	69·4	3·78					
1445	20	0	—	3·51	34·14	27·18	1·60	—	0·14	12·6	6·93	**N 50 V**	100–0	0910		
		5	—	3·51	—	—	—	—	—	—	—	**N 70 V**	50–0			**N 70 V** samples from 100–50, 500–250 and 1000–750 m. were subsequently lost owing to bad weather, although the samples from 100–50 and 500–250 m. had already been analysed
		10	—	3·51	34·14	27·18	1·60	—	0·14	13·3	—	,,	100–50			
		20	—	3·48	34·14	27·18	1·67	—	0·14	14·0	6·96	,,	250–100			
		30	—	3·48	34·14	27·18	1·71	—	0·14	14·0	—	,,	500–250			
		40	—	3·50	34·14	27·18	1·73	—	0·13	13·8	6·96	,,	750–500			
		50	—	3·50	34·14	27·18	1·73	—	0·14	14·0	—	,,	1000–750			
		60	—	3·50	34·14	27·18	1·73	—	0·14	14·1	6·87	**NHP**	50–0	—	1039	
		80	—	3·50	34·14	27·18	1·73	—	0·14	14·3	—	**CWS**	0			
		100	—	3·46	34·14	27·19	1·75	—	0·14	14·6	6·88	,,	5			
		150	—	3·42	34·14	27·19	1·73	—	0·14	14·8	6·89	,,	10			
		200	—	3·35	34·14	27·20	1·73	—	0·12	14·6	6·87	,,	20			
		300	—	2·89	34·13	27·22	1·81	—	0·00	16·7	6·54	,,	50			
		400	—	2·19	34·13	27·28	1·84	—	0·11?	18·4	6·87	,,	100			
		600^1	603	3·35	34·32	27·33	2·38	—	—	33·2	4·67	**N 70 B**	} 100–0	1236	1256	KT
		800^1	—	2·89	34·42	27·45	2·68	—	—	46·3	4·26	**N 100 B**				
		1000^1	—	2·56	34·49	27·53	2·68	—	—	54·6	3·95	**N 70 B**	} 310–200	1236	1306	DGP
		1500^1	—	2·27	(34·62)	(27·68)	2·59?	—	—	60·9?	3·76?	**N 100 B**				
		2000^1	1772?	2·08	34·70	27·75	2·68	—	—	72·1	3·86					
		2500^2	2496	1·65	34·73	27·81	2·68	—	—	84·3	3·91					
		3000^2	—	1·36	34·75	27·85	2·68	—	—	88·1	4·13					
		3500^2	—	0·98	34·74	27·86	2·68	—	—	99·6						
		4000^2	—	0·73	(34·73)	(27·87)	2·68?	—	—	104·3?	3·96?					
		4500^2	4502	0·55	34·72	27·87	2·68	—	—	100·8	4·37					
1446	20	0	—	2·73	34·05	27·17	1·63	—	0·14	13·5	7·08	**N 50 V**	100–0	**2017**		
		5	—	2·75	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	2·71	34·05	27·17	1·75	—	0·13	14·3	—	,,	100–50			
		20	—	2·71	34·05	27·17	1·82	—	0·13	14·7	7·11	,,	250–100			
		30	—	2·71	34·05	27·17	1·73	—	0·14	15·1	—	,,	500–250			
		40	—	2·71	34·05	27·17	1·79	—	0·14	15·4	7·11	,,	750–500			
		50	—	2·63	34·05	27·18	1·81	—	0·14	15·5	—	,,	1000–750			
		60	—	2·61	34·05	27·18	1·81	—	0·13	15·6	7·10	**NHP**	50–0	—	**2148**	
		80	—	2·61	34·05	27·18	1·81	—	0·14	16·2	—	**CWS**	0			
		100	—	2·61	34·05	27·18	1·86	—	0·14	16·2	7·07	,,	5			
		150	—	2·47	34·05	27·19	1·82	—	0·16	16·9	6·88	,,	10			
		200	—	2·13	34·05	27·22	1·90	—	0·10	17·9	6·88	,,	20			
		300	—	2·03	34·08	27·26	2·07	—	0·00	18·1	6·44	,,	50			
		400	—	2·59	34·22	27·31	2·40	—	0·00	29·0	5·58	,,	100			
		590^1	581	2·80	34·34	27·40	2·68	—	—	38·0	4·35	**N 70 B**	} 91–0	**2215**	**2235**	KT
		790^1	—	2·73	34·44	27·49	2·76	—	—	49·7	4·01	**N 100 B**				
		980^1	—	2·52	34·57	27·61	2·81	—	—	58·5	3·74	**N 70 B**	} 370–230	**2215**	**2245**	DGP
		1480^1	—	2·22	(34·70)	(27·74)	2·81?	—	—	41·5?	3·56?	**N 100 B**				
		1970^1	1977	1·89	34·73	27·79	2·76	—	—	79·7	3·92					
1447	21	0	—	−0·37	33·89	27·25	1·96	—	0·28	18·9	7·65	**N 50 V**	100–0	0914		
		5	—	−0·37	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·38	33·89	27·25	2·01	—	0·28	19·3	—	,,	100–50			
		20	—	−0·38	33·89	27·25	2·03	—	0·27	19·5	—	,,	250–100			
		30	—	−0·38	33·89	27·25	2·09	—	0·27	19·7	—	,,	500–250			
		40	—	−0·38	33·89	27·25	2·11	—	0·27	19·8	7·66	,,	750–500			
		50	—	−0·38	33·89	27·25	2·13	—	0·28	19·4	—	,,	1000–750			
		60	—	−0·39	33·89	27·25	2·28	—	0·26	19·8	7·65	**NHP**	50–0	—	1039	
		80	—	−0·38	33·89	27·25	2·13	—	0·26	16·7	—	**CWS**	0			
		100	—	−0·36	33·89	27·25	2·13	—	0·26	19·6	7·62	,,	5			
		150	—	−0·09	33·95	27·28	2·13	—	0·26	19·6	7·49	,,	10			
		200	—	0·42	34·02	27·32	2·17	—	0·00	20·0	6·98	,,	20			
		300	—	1·35	34·17	27·38	2·43	—	0·00	33·3	5·88	,,	50			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1447 *cont.*	62° 37·7′ S, 79° 28·6′ W	1934 29 x											
1448	63° 43·8′ S, 79° 21·8′ W	29 x	2000	4590*	NW × W	12	NW × W	3	ome	970·3	0·0	−0·3	mod. NW × W swell
1449	65° 03·4′ S, 79° 23·6′ W	30 x	0900	4067*	W × S	15	W × S	4	c	967·2	−2·3	−3·1	mod. W swell
1450	66° 03·1′ S, 79° 42·2′ W	30–31 x	2000 0000	3989* —	WNW NNW	13 10	WNW NNW	2 2	o o	973·1 972·9	−3·4 −3·6	−4·0 −4·2	mod. conf. NW swell mod. conf. NW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S °/₀₀	σt	P	Nitrate + Nitrite N	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1447	21	395	—	2·24	34·36	27·46	2·60	—	0·00	42·8	4·68	**CWS**	100			
cont.		590[1]	591	2·42	34·50	27·56	2·74	—	—	51·8	3·93	**N 70 B**	179–0	1234	1254	KT
		790[1]	—	2·34	34·60	27·64	2·76	—	—	60·2	3·75	**N 100 B**				
		990[1]	—	2·24	(34·67)	(27·71)	2·78?	—	—	45·3?	3·62?	**N 70 B**	520–370	1234	1305	DGP
		1480[1]	—	1·99	34·74	27·79	2·60	—	—	66·2	3·95	**N 100 B**				
		1970[1]	1970	1·64	34·75	27·83	2·66	—	—	74·0	4·03					
		2500[2]	2512	1·31	34·74	27·84	2·66	—	—	83·9	4·23					
		3000[2]	—	1·02	34·74	27·86	2·70	—	—	81·5	4·39					
		3500[2]	—	0·71	34·72	27·86	2·70	—	—	94·8	4·48					
		4000[2]	—	0·51	(34·71)	(27·87)	2·70?	—	—	76·6?	4·09?					
		4500[2]	4490	0·45	34·70	27·87	2·70	—	—	111·9	4·53					
1448	21	0	—	−1·16	33·84	27·24	2·05	—	0·25	19·6	7·84	**N 50 V**	100–0	**2014**		
		5	—	−1·16	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·16	33·85	27·25	2·05	—	0·26	19·3	—	,,	100–50			
		20	—	−1·16	33·85	27·25	2·05	—	0·26	19·1	7·83	,,	250–100			
		30	—	−1·16	33·85	27·25	2·05	—	0·27	19·1	—	,,	500–250			
		40	—	−1·16	33·85	27·25	2·09	—	0·25	19·0	7·84	,,	750–500			
		50	—	−1·16	33·85	27·25	2·11	—	0·26	17·6	—	,,	1000–750			
		60	—	−1·17	33·85	27·25	2·11	—	0·26	17·6	7·80	**NHP**	50–0	—	**2133**	
		80	—	−1·19	33·85	27·25	2·11	—	0·26	17·4	—	**CWS**	0			
		100	—	−1·19	33·85	27·25	2·11	—	0·25	17·9	7·78	,,	5			
		150	—	−1·19	33·86	27·25	2·11	—	0·25	18·3	7·73	,,	10			
		200	—	0·50	34·04	27·32	2·32	—	0·00	25·5	6·55	,,	20			
		300	—	1·83	34·28	27·43	2·66	—	0·00	34·9	5·02	,,	50			
		400	—	2·15	34·41	27·51	2·78	—	0·00	48·6	4·33	,,	100			
		600[1]	595	2·24	34·56	27·62	2·85	—	—	52·3	3·71	**N 70 B**	99–0	**2150**	**2210**	KT
		800[1]	—	2·20	34·62	27·68	2·78	—	—	66·7?	3·76	**N 100 B**				
		1000[1]	—	2·12	34·69	27·73	2·78	—	—	62·7	3·77	**N 70 B**	340–200	**2150**	**2220**	DGP
		1500[1]	—	1·83	(34·74)	(27·80)	2·74?	—	—	52·9?	3·75?	**N 100 B**				
		2000[1]	2009	1·48	34·75	27·84	2·78	—	—	83·9	4·11	**N 100 H**	0–5	**2150**	**2220**	
1449	22	0	—	−1·62	33·91	27·31	2·17	—	0·21	30·5	7·54	**N 50 V**	100–0	0914	—	+7 hours
		5	—	−1·62	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·63	33·91	27·31	2·17	—	0·21	30·2	—	,,	100–50			
		20	—	−1·63	33·91	27·31	2·22	—	0·21	30·2	—	,,	250–100			
		30	—	−1·63	33·91	27·31	2·22	—	0·19	30·8	—	,,	500–250			
		40	—	−1·63	33·91	27·31	2·22	—	0·19	30·5	7·71	,,	750–500			
		50	—	−1·63	33·91	27·31	2·22	—	0·20	30·5	—	,,	1000–750			
		60	—	−1·63	33·91	27·31	2·22	—	0·20	30·3	7·53	**NHP**	50–0	—	1103	
		80	—	−1·63	33·91	27·31	2·22	—	0·20	30·6	—	**CWS**	0			
		100	—	−1·63	33·91	27·31	2·24	—	0·20	29·8	7·44	,,	5			
		150	—	0·74	34·26	27·49	2·60	—	0·00	44·6	5·42	,,	10			
		195	—	1·26	34·37	27·54	2·62	—	0·00	51·6	4·88	,,	20			
		295	—	1·95	34·51	27·60	2·62	—	0·00	55·7	4·08	,,	50			
		390	—	2·04	34·59	27·67	2·70	—	0·00	59·3	3·90	,,	100			
		590[1]	581	2·04	34·67	27·73	2·74	—	—	63·6	3·84	**N 70 B**	109–0	1208	1228	KT
		780[1]	—	1·96	(34·71)	(27·77)	2·74?	—	—	63·0?	3·78?	**N 100 B**				
		980[1]	—	1·89	34·73	27·79	2·68	—	—	62·2	4·03	**N 70 B**	390–160	1208	1238	DGP
		1470[1]	1476	1·49	34·75	27·84	2·62	—	—	78·1	4·28	**N 100 B**				
		2000[2]	2009	1·11	34·74	27·85	2·62	—	—	84·3	4·47					
		2500[2]	—	0·86	34·72	27·85	2·66	—	—	86·7	4·52					
		3000[2]	—	0·62	34·71	27·87	2·66	—	—	100·5	4·43					
		3500[2]	—	0·43	(34·71)	(27·88)	2·70?	—	—	74·6?	4·08?					
		4000[2]	4015	0·33	34·70	27·87	2·74	—	—	103·3	4·52					
1450	22	0	—	−1·83	33·92	27·33	2·28	—	0·19	33·3	7·19	**N 50 V**	100–0	**2010**		
		5	—	−1·81	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·81	33·92	27·33	2·15	—	0·19	33·0	—	,,	100–50			
		20	—	−1·81	33·92	27·33	2·20	—	0·19	32·6	7·24	,,	250–100			
		30	—	−1·81	33·92	27·33	2·22	—	0·18	32·6	—	,,	500–250			
		40	—	−1·81	33·92	27·33	2·22	—	0·18	32·7	7·20	,,	750–500			
		50	—	−1·81	33·92	27·33	2·22	—	0·19	33·0	—	,,	1000–750			
		60	—	−1·81	33·92	27·33	2·22	—	0·19	32·9	7·18	**NHP**	50–0	—	**0045**	
		80	—	−1·79	33·95	27·35	2·30	—	0·19	33·0	—	**CWS**	0			
		100	—	−1·69	33·99	27·38	2·36	—	0·18	33·0	6·94	,,	5			
		150	—	1·02	34·32	27·52	2·62	—	0·00	44·3	5·05	,,	10			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. °C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1450 *cont.*	66° 03·1′ S, 79° 42·2′ W	1934 30–31 x											
1451	64° 00·5′ S, 84° 02·3′ W	31 x	2000	4488*	W	12	W	3	bc	965·2	−2·1	−2·3	mod. W swell
1452	63° 06·8′ S, 86° 00·6′ W	1 xi	0900	4680*	W	26	W	5	c	965·8	−0·6	−0·6	mod. conf. W swell
1453	62° 13·1′ S, 87° 57·4′ W	1–2 xi	2000	4819*	WSW	16	WSW	3	oqh	979·8	−3·9	−3·9	mod. WSW swell
			0000	—	W	10	W	3	o	981·2	−3·2	−3·3	mod. conf. WSW swell
1454	63° 03′ S, 89° 34·5′ W	2 xi	0900	4687*	W × N	24	W × N	4	c	968·3	0·6	0·6	heavy conf. W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S °/₀₀	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
1450 *cont.*	22	200	—	1·72	34·43	27·56	2·78	—	0·00	51·5	4·38	**CWS**	20			
		300	—	2·05	34·56	27·64	2·78	—	0·00	54·8	3·91	,,	50			
		400	—	2·05	34·59	27·67	2·76	—	0·00	56·9	3·88	,,	100			
		600^1	599	2·06	34·67	27·72	2·76	—	—	61·7	3·84	**N 70 B**	155–0	**0140**	**0200**	KT
		800^1	—	1·94	34·70	27·76	2·76	—	—	62·9	3·92	**N 100 B**				
		1000^1	1010	1·80	34·73	27·79	2·70	—	—	66·5	4·14	**N 70 B**	520–310	**0140**	**0210**	DGP
		1470^2	1477	1·47	34·75	27·84	2·68	—	—	77·2	4·08	**N 100 B**				
		1960^2	—	1·13	34·74	27·85	2·64	—	—	76·6	4·07	**N 100 H**	0–5	**0140**	**0210**	
		2450^2	—	0·86	34·72	27·85	2·66	—	—	86·2	4·30					
		2940^2	—	0·64	(34·71)	(27·86)	2·72?	—	—	90·2?	4·15?					
		3430^2	3425	0·44	34·71	27·88	2·76	—	—	86·8	4·41					
1451	23	0	—	−0·44	33·87	27·24	1·90	—	0·29	18·1	7·68	**N 50 V**	100–0	**2013**		
		10	—	−0·45	33·87	27·24	1·90	—	0·29	18·0	—	**N 70 V**	50–0			
		20	—	−0·46	33·87	27·24	1·92	—	0·29	17·6	7·65	,,	100–50			
		30	—	−0·47	33·87	27·24	1·94	—	0·29	17·6	—	,,	250–100			
		40	—	−0·49	33·87	27·24	2·01	—	0·29	18·0	7·66	,,	500–250			
		50	—	−0·49	33·87	27·24	2·07	—	0·28	18·0	—	,,	750–500			
		60	—	−0·49	33·87	27·24	2·07	—	0·29	18·3	7·62	,,	1000–750			
		80	—	−0·49	33·87	27·24	2·07	—	0·28	18·7	—	**NHP**	50–0	—	**2130**	
		100	—	−0·46	33·88	27·25	2·07	—	0·28	18·4	7·57	**N 70 B**	146–0	**2308**	**2328**	KT
		150	—	−0·41	33·88	27·25	2·03	—	0·27	18·4	7·56	**N 100 B**				
		200	—	0·82	34·06	27·32	2·32	—	0·00	25·4	6·59	**N 70 B**	500–200	**2308**	**2338**	DGP
		300	—	1·86	34·25	27·40	2·49	—	0·00	35·4	5·23	**N 100 B**				
		400	—	2·21	34·38	27·48	2·60	—	0·00	45·5	4·57	**N 100 H**	0–5	**2308**	**2338**	
		600^1	600	2·33	34·50	27·56	2·79	—	—	51·6	3·83					
		800^1	—	2·26	34·59	27·65	2·83	—	—	58·8	3·83					
		1000^1	—	2·17	(34·66)	(27·71)	2·64?	—	—	58·0?	3·66?					
		1500^1	1504	1·92	34·75	27·80	2·64	—	—	65·9	3·94					
		2000^2	2005	1·52	34·75	27·84	2·76	—	—	74·2	4·15					
		2500^2	—	1·22	34·75	27·86	2·64	—	—	79·1	4·29					
		3000^2	—	0·91	34·72	27·85	2·70	—	—	88·6	4·28					
		3500^2	—	0·62	(34·71)	(27·87)	2·78?	—	—	75·5?	4·00?					
		4000^2	3991	0·46	34·71	27·87	2·81	—	—	98·5	4·45					
1452	24	0	—	−0·70	33·88	27·26	—	—	—	—	—	**N 50 V**	100–0	0905		
												NHP	50–0	—	0920	
												N 70 B	146–0	0929	0949	KT
												N 100 B				
1453	24	0	—	1·22	34·00	27·25	1·79	—	0·12	16·4	7·34	**N 50 V**	100–0	**2011**		
		10	—	1·23	34·00	27·25	1·79	—	0·12	16·4	—	**N 70 V**	50–0			
		20	—	1·23	34·00	27·25	1·81	—	0·13	16·8	7·34	,,	100–50			
		30	—	1·23	34·00	27·25	1·84	—	0·11	18·5	—	,,	250–100			
		40	—	1·23	34·00	27·25	1·96	—	0·12	18·3	7·33	,,	500–250			
		50	—	1·23	34·00	27·25	2·05	—	0·12	18·5	—	,,	750–500			
		60	—	1·23	34·00	27·25	2·05	—	0·12	18·3	7·30	,,	1000–750			
		80	—	1·23	34·00	27·25	2·05	—	0·12	18·4	—	**NHP**	50–0	—	**2135**	
		100	—	1·23	34·00	27·25	2·05	—	0·12	18·5	7·25	**N 70 B**	124–0	**0019**	**0039**	KT
		150	—	1·23	34·00	27·25	2·07	—	0·12	18·4	7·23	**N 100 B**				
		200	—	1·21	34·00	27·25	2·19	—	0·12	18·3	7·21	**N 70 B**	500–300	**0019**	**0050**	DGP
		300	—	2·23	34·15	27·30	2·41	—	0·00	26·7	5·67	**N 100 B**				
		400	—	2·09	34·23	27·37	2·64	—	0·00	31·6	5·38					
		590^1	590	2·56	34·42	27·47	2·79	—	—	44·0	4·07					
		790^1	—	2·37	34·52	27·58	2·83	—	—	52·4	3·81					
		990^1	—	2·29	(34·60)	(27·65)	2·66?	—	—	47·6?	3·56?					
		1490^1	—	2·05	34·70	27·75	2·66	—	—	68·0	3·89					
		1990^1	1993	1·63	34·74	27·82	2·60	—	—	75·4	4·01					
		2490^2	2485	1·39	34·75	27·84	2·60	—	—	83·6	3·97					
		2980^2	—	1·06	34·74	27·86	2·66	—	—	88·8	4·31					
		3480^2	—	0·77	34·73	27·87	2·72	—	—	96·5	4·24					
		3980^2	—	0·50	(34·72)	(27·87)	2·72?	—	—	69·7?	3·83?					
		4480^2	4476	0·41	34·71	27·88	2·72	—	—	108·6	4·40					
1454	25	0	—	−1·20	33·86	27·25	—	—	—	—	—	**N 50 V**	100–0	0910		
												NHP	50–0	—	0920	
												N 70 B	119–0	0927	0947	KT
												N 100 B				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1455	63° 52·3′ S, 91° 25·9′ W	1934 2–3 xi	2000 0000	4812* —	W NW × W	20 26–30	W NW × N	4 5	bcsq o	972·9 970·4	−1·3 −1·1	−1·3 −1·2	mod. W × S swell mod. conf. W × S swell
1456	64° 19′ S, 92° 44·6′ W	3 xi	0900	4627*	W × S	20	W × S	5	bc	972·8	−0·9	−0·9	heavy conf. W swell
1457	65° 06·3′ S, 94° 55·3′ W	3 xi	2000	4687*	W × N	40	W × N	6	oq	962·6	−1·8	−2·0	heavy conf. W swell
1458	65° 43·5′ S, 97° 07·6′ W	4 xi	0900	4695*	SW × S	10	SW	2	c	972·0	−4·4	−4·4	mod. W swell
1459	65° 45·2′ S, 97° 20·9′ W	4 xi	1045	4702*	SW × W	12	SW × W	2	c	975·0	−4·3	−4·3	low conf. swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.^{3}							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1455	25	0	—	−1·64	33·87	27·28	2·03	—	0·24	20·5	7·82	**N 50 V**	100–0	**2012**		
		10	—	−1·64	33·87	27·28	2·03	—	0·24	20·7	—	**N 70 V**	50–0			
		20	—	−1·64	33·87	27·28	2·13	—	0·23	21·5	7·80	,,	100–50			
		30	—	−1·64	33·87	27·28	1·96	—	0·24	23·0	—	,,	250–100			
		40	—	−1·64	33·87	27·28	2·09	—	0·24	20·5	7·80	,,	500–250			
		50	—	−1·64	33·87	27·28	2·09	—	0·23	23·0	—	,,	750–500			
		60	—	−1·66	33·87	27·28	2·09	—	0·24	22·3	7·77	,,	1000–750			
		80	—	−1·67	33·87	27·28	2·09	—	0·22	21·7	—	**NHP**	50–0	—	**2142**	
		100	—	−1·69	33·87	27·28	2·09	—	0·22	22·5	7·78	**N 70 B**	150–0	**2357**	**0017**	KT
		150	—	−1·79	33·88	27·30	2·19	—	0·21	22·1	7·64	**N 100 B**				
		195	—	0·15	34·10	27·39	2·36	—	0·00	29·2	6·26	**N 70 B**	520–230	**2357**	**0027**	DGP
		295	—	1·73	34·33	27·47	2·64	—	0·00	45·0	4·80	**N 100 B**				
		390	—	2·06	34·46	27·56	2·74	—	0·00	49·7	4·15					
		590^1	580	2·17	34·59	27·66	2·74	—	—	56·2	3·73					
		780^1	—	2·13	34·62	27·69	2·74	—	—	63·0	3·72					
		980^1	—	2·09	34·68	27·73	2·66	—	—	63·8	3·88					
		1470^1	—	1·75	(34·72)	(27·79)	2·59?	—	—	54·3?	3·91?					
		1960^1	1962	1·41	34·74	27·83	2·59	—	—	80·8	4·14					
		2440^2	2416	1·13	34·73	27·84	2·64	—	—	86·1	4·04					
		2930^2	—	0·86	(34·72)	(27·85)	2·72?	—	—	91·8?	3·92?					
		3420^2	—	0·64	34·71	27·86	2·76	—	—	97·6	4·40					
		3910^2	—	0·42	34·70	27·87	2·76	—	—	103·0	4·47					
		4400^2	4422	0·37	34·70	27·87	2·76	—	—	93·6	4·46					
1456	26	0	—	−1·30	33·86	27·25	—	—	—	—	—	**N 50 V**	100–0	0908		
												NHP	50–0	—	0917	
												N 70 B **N 100 B**	137–0	0926	0946	KT. **N 100 B** may not have fished properly
1457	26	0	—	−1·60	33·87	27·28	—	—	—	—	—	**N 70 V**	250–100	**2015**	—	Remainder of station abandoned on account of rising wind and sea
		400	—	2·06	34·49	27·58	2·74	—	0·00	51·0	4·06	,,	500–0	—	**2045**	
1458	27	0	—	−1·65	33·89	27·29	—	—	—	—	—	**N 50 V**	100–0	0907	—	+8 hours
												NHP	50–0	—	0920	
												N 70 B **N 100 B**	146–0	0932	0952	KT
												N 70 B **N 100 B**	520–200	0932	1002	DGP
1459	27	0	—	−1·79	33·87	27·29	2·13	—	0·24	20·8	7·79	**N 70 V**	50–0	1100		
		10	—	−1·79	33·87	27·29	2·09	—	0·24	21·4	—	,,	100–50			
		20	—	−1·79	33·87	27·29	2·15	—	0·24	23·3	7·79	,,	250–100			
		30	—	−1·79	33·87	27·29	2·17	—	0·24	23·4	—	,,	500–250			
		40	—	−1·81	33·87	27·29	2·19	—	0·24	22·5	7·76	,,	750–500			
		50	—	−1·82	33·87	27·29	2·17	—	0·23	24·1	—	,,	1000–750	—	1208	
		60	—	−1·83	33·87	27·29	2·19	—	0·23	23·9	7·75					
		80	—	−1·85	33·87	27·29	2·19	—	0·24	23·8						
		100	—	−1·87	33·88	27·30	2·19	—	0·22	23·9	7·64					
		150	—	−1·78	33·91	27·32	2·22	—	0·27	25·2	7·55					
		195	—	0·51	34·13	27·39	2·51	—	0·00	33·0	6·10					
		295	—	1·78	34·33	27·47	2·66	—	0·00	45·2	4·73					
		390	—	2·05	34·43	27·54	2·74	—	0·00	48·0	4·15					
		590^1	583	2·17	34·57	27·64	2·74	—	—	54·1	3·70					
		790^1	—	2·15	34·66	27·71	2·72	—	—	62·8	3·67					
		980^1	—	2·08	34·69	27·73	2·70	—	—	68·6	3·83					
		1470^1	—	1·76	34·74	27·81	2·51	—	—	71·5	4·03					
		1960^1	1969	1·39	34·75	27·84	2·66	—	—	79·7	4·17					
		2470^2	2473	1·09	34·73	27·84	2·66	—	—	85·0	4·07					
		2970^2	—	0·85	34·71	27·85	2·66	—	—	93·9	4·37					
		3460^2	—	0·61	34·71	27·87	2·66	—	—	106·3	4·41					
		3960^2	—	0·42	34·70	27·87	2·68	—	—	108·9	4·44					
		4450^2	4450	0·36	(34·70)	(27·87)	2·72?	—	—	46·1?	4·08?					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1460	65° 02·9′ S, 99° 12·1′ W	1934 4 xi	2200	4797*	W × N	8	W × N	2	o	979·6	−4·2	−4·6	low conf. SW swell
1461	64° 03·3′ S, 101° 43·2′ W	5 xi	0900	4894*	E × N	25	E × N	5	os	967·9	−1·1	−1·7	heavy E × N swell
1462	63° 01·3′ S, 104° 15·8′ W	5–6 xi	2000	4974*	SSW	13	SSW	3	o	980·4	−2·2	−2·3	mod. very conf. S swell
			0000	—	WSW	15	WSW	4	c	984·1	−1·7	−2·2	mod. conf. W and SE swells
1463	63° 50·9′ S, 106° 01·1′ W	6 xi	0900	4962*	W	20	W	5	bc	986·0	0·0	0·0	heavy conf. W and NW swells
1464	64° 56·5′ S, 108° 06·6′ W	6–7 xi	2000	4834*	NW × W N × E	10	N	2	os	984·2	−0·8	−0·9	mod. WNW swell
			0000	—	NNE	8	NNE	2	os	977·0	−0·6	−0·6	mod. conf. WNW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	Mg.—atom m.³				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1460	27	0	—	−1·35	33·88	27·28	—	—	—	—	4·08	**N 50 V**	100–0	**2205**		
												NHP	50–0	—	**2218**	
												N 70 B	146–0	**2235**	**2255**	KT
												N 100 B				
												N 70 B	520–290	**2235**	**2305**	DGP
												N 100 B				
												N 100 H	0–5	**2235**	**2306**	
1461	28	0	—	−0·45	33·96	27·31	—	—	—	—	—	**N 50 V**	100–0	0912		
												NHP	50–0	—	0923	
												N 70 B	88–0	0929	0949	KT
												N 100 B				
1462	28	0	—	−0·89	33·90	27·28	2·15	—	0·20	20·6	7·72	**N 50 V**	100–0	**2011**		
		10	—	−0·89	33·90	27·28	2·03	—	0·20	22·1	—	**N 70 V**	50–0			
		20	—	−0·89	33·90	27·28	2·15	—	0·19	22·6	7·72	,,	100–50			
		30	—	−0·89	33·90	27·28	2·15	—	0·19	22·4	—	,,	250–100			
		40	—	−0·89	33·90	27·28	2·15	—	0·19	22·5	7·74	,,	500–250			
		50	—	−0·89	33·90	27·28	2·15	—	0·19	22·6	—	,,	750–500			
		60	—	−0·90	33·91	27·29	2·19	—	0·19	22·7	7·70	,,	1000–750			
		80	—	−0·90	33·91	27·29	2·15	—	0·19	22·1	—	**NHP**	50–0	—	**2144**	
		100	—	−0·98	33·91	27·29	2·15	—	0·19	23·4	7·70	**N 70 B**	93–0	**2354**	**0014**	KT
		150	—	−0·99	33·93	27·30	2·15	—	0·19	23·3	7·62	**N 100 B**				
		200	—	0·37	34·11	27·39	2·34	—	0·00	30·5	6·55	**N 70 B**	380–210	**2354**	**0024**	DGP
		300	—	1·81	34·33	27·46	2·62	—	0·00	39·7	4·85	**N 100 B**				
		395	—	2·02	34·43	27·54	2·72	—	0·00	47·6	4·34					
		590^1	599	2·20	34·55	27·62	2·85	—	—	56·9	3·76					
		790^1	—	2·20	34·65	27·69	2·74	—	—	62·3	3·74					
		990^1	—	2·11	34·70	27·75	2·74	—	—	64·9	3·79					
		1480^1	—	1·85	34·74	27·80	2·55	—	—	67·6	4·11					
		1980^1	1973	1·44	34·75	27·84	2·51	—	—	74·9	4·22					
		2460^2	2458	1·15	34·74	27·85	2·49	—	—	80·8	4·04					
		2950^2	—	0·91	34·72	27·85	2·59	—	—	93·9	4·24					
		3440^2	—	0·67	34·71	27·86	2·68	—	—	95·6	4·43					
		3930^2	—	0·44	34·70	27·87	2·68	—	—	105·0	4·37					
		4420^2	—	0·35	34·70	27·87	2·72	—	—	96·1	4·51					
1463	29	0	—	−1·28	33·94	27·32	—	—	—	—	—	**N 50 V**	100–0	0905		
												NHP	50–0	—	0917	
												N 70 B	146–0	0923	0943	Depth estimated
												N 100 B				
1464	29	0	—	−1·27	33·88	27·28	1·77	—	0·21	23·5	7·78	**N 50 V**	100–0	**2011**		
		10	—	−1·27	33·88	27·28	1·96	—	0·21	23·5	—	**N 70 V**	50–0			
		20	—	−1·27	33·88	27·28	1·88	—	0·21	23·2	7·78	,,	100–50			
		30	—	−1·27	33·88	27·28	1·92	—	0·21	23·4	—	,,	250–100			
		40	—	−1·27	33·88	27·28	1·92	—	0·21	23·9	7·75	,,	500–250			
		50	—	−1·28	33·88	27·28	1·92	—	0·21	24·0	—	,,	750–500			
		60	—	−1·28	33·88	27·28	1·90	—	0·20	23·6	7·74	,,	1000–750			
		80	—	−1·29	33·88	27·28	1·90	—	0·21	23·9	—	**NHP**	50–0	—	**2200**	
		100	—	−1·29	33·88	27·28	1·94	—	0·19	23·5	7·74	**N 70 B**	104–0	**2327**	**2347**	KT
		150	—	−1·10	33·88	27·28	1·96	—	0·19	24·3	7·66	**N 100 B**				
		200	—	0·23	34·06	27·36	2·15	—	0·00	30·7	6·51	**N 70 B**	360–190	**2327**	**2357**	DGP
		300	—	1·73	34·32	27·47	2·49	—	0·00	45·7	4·86	**N 100 B**				
		400	—	2·14	34·46	27·55	2·83	—	0·00	52·3	4·14	**N 100 H**	0–5	**2327**	**2358**	
		600^1	599	2·20	34·56	27·62	2·83	—	—	59·0	3·78					
		800^1	—	2·17	34·65	27·70	2·83	—	—	65·2	3·79					
		1000^1	—	2·09	34·69	27·73	2·83	—	—	68·7	3·80					
		1490^1	—	1·77	34·73	27·80	2·81	—	—	74·5	4·15					
		1990^1	1989	1·42	34·75	27·84	2·60	—	—	83·3	4·22					
		2500^2	2499	1·11	34·73	27·84	2·81	—	—	84·3	4·20					
		3000^2	—	0·84	34·71	27·85	2·83	—	—	93·9	4·54					
		3500^2	—	0·60	34·71	27·87	2·78	—	—	95·6	4·52					
		4000^2	—	0·40	34·70	27·87	2·83	—	—	111·9	4·53					
		4500^2	4508	0·34	34·70	27·87	2·83	—	—	103·5	4·70					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1465	65° 38·8′ S, 109° 33·7′ W	1934 7 xi	0900	4812*	NNW	10	NNW	4	om	962·4	−0·1	−0·2	mod. NW swell
1466	61° 32·7′ S, 107° 00·5′ W	9 xi	0900	5110*	N × E	16	N	3	osp	994·1	0·5	−0·6	mod. WNW swell
			1200	—	WNW	20	NNW	3	b	990·8	1·6	0·6	mod. NW × N swell
1467	59° 28·3′ S, 96° 12·2′ W	11 xi	0900	4495*	NNW	30	NNW	4	oqe	976·5	4·4	4·3	heavy conf. NNW swell
			1200	—	NNW	30	NNW	6	oqe	974·3	5·1	4·5	heavy conf. NNW swell
1468	60° 46·5′ S, 95° 57·3′ W	11 xi	2100	4605*	WNW	12	WNW	4	b	980·0	2·2	1·1	heavy conf. WNW swell
1469	62° 18·9′ S, 95° 52·4′ W	12 xi	0900	4894*	WNW	10	WNW	2	b	977·0	1·9	1·9	heavy WNW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.^{3}							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1465	0	0	—	−1·30	33·89	27·28	—	—	—	—	—	**N 50 V**	100–0	0910		
												NHP	50–0	—	0926	
												N 70 B	105–0	0941	1001	KT
												N 100 B				
												N 70 B	360–170	0941	1012	DGP
												N 100 B				
1466	2	0	—	0·90	34·00	27·27	1·94	—	0·14	17·3	7·49	**N 50 V**	100–0	0916		
		10	—	0·90	34·00	27·27	1·92	—	0·14	18·3	—	**N 70 V**	50–0			
		20	—	0·89	34·00	27·27	1·94	—	0·13	17·8	7·47	,,	100–50			
		30	—	0·88	34·00	27·27	2·07	—	0·14	18·3	—	,,	250–100			
		40	—	0·87	34·00	27·27	1·90	—	0·13	18·4	7·43	,,	500–250			
		50	—	0·87	34·00	27·27	1·98	—	0·13	18·9	—	,,	750–500			
		60	—	0·87	34·00	27·27	1·98	—	0·13	19·2	7·43	,,	1000–750			
		80	—	0·87	34·00	27·27	2·01	—	0·12	19·3	—	**NHP**	50–0	—	1055	
		100	—	0·87	34·00	27·27	2·05	—	0·12	19·0	7·38	**N 70 B**	128–0	1304	1324	KT
		150	—	0·86	34·00	27·27	2·15	—	0·12	18·9	7·40	**N 100 B**				
		200	—	0·87	34·02	27·29	2·07	—	0·13	19·3	7·39	**N 70 B**	440–250	1304	1334	DGP
		300	—	1·86	34·20	27·36	2·07	—	0·00	32·9	5·61	**N 100 B**				
		400	—	2·16	34·31	27·43	2·38	—	0·00	40·9	4·94					
		600	—	2·30	34·44	27·53	2·57	—	—	47·4	4·17					
		800^1	792	2·28	34·58	27·64	2·70	—	—	52·5	3·78					
		1000^1	—	2·24	34·65	27·69	2·66	—	—	61·7	3·81					
		1500^1	—	1·97	34·73	27·78	2·49	—	—	67·1	4·01					
		2000^1	—	1·61	34·75	27·83	2·53	—	—	72·1	4·17					
		2500^1	2502	1·28	34·75	27·85	2·51	—	—	75·6	4·32					
		2990^2	2994	0·99	34·73	27·85	2·51	—	—	82·2	4·23					
		3480^2	—	0·76	34·72	27·86	2·51	—	—	86·0	4·59					
		3980^2	—	0·47	34·71	27·87	2·51	—	—	94·7	4·50					
		4480^2	—	0·37	34·70	27·87	2·49	—	—	96·5	4·60					
		4980^2	4967	0·36	34·70	27·87	2·53	—	—	94·8	4·63					
1467	4	0	—	2·51	34·05	27·19	1·98	—	0·14	19·4	7·01	**N 70 V**	50–0	0935		
		10	—	2·51	34·05	27·19	2·00	—	0·13	18·9	—	,,	100–50			
		20	—	2·51	34·05	27·19	2·00	—	0·13	18·6	7·02	,,	250–100			
		30	—	2·51	34·05	27·19	2·00	—	0·13	18·7	—	,,	500–250			
		40	—	2·51	34·05	27·19	2·00	—	0·13	19·0	7·01	,,	750–500			
		50	—	2·51	34·05	27·19	2·03	—	0·12	19·1	—	,,	1000–750			
		60	—	2·50	34·05	27·19	2·00	—	0·12	19·3	6·99	**NHP**	50–0	—	1115	
		80	—	2·49	34·05	27·19	2·00	—	0·14	19·0	—	**N 100 B**	155–0	1143	1203	KT
		100	—	2·42	34·05	27·20	2·01	—	0·13	19·2	6·99	**N 100 B**	520–230	1143	1213	DGP
		150	—	1·82	34·05	27·25	2·01	—	0·13	19·4	7·07					
		195	—	1·12	33·99	27·25	2·03	—	0·14	19·3	7·25					
		290	—	1·67	34·05	27·26	2·05	—	0·00	23·3	6·58					
		390	—	2·40	34·22	27·33	2·41	—	0·00	34·3	5·31					
		580^1	582	2·39	34·34	27·44	2·72	—	—	45·0	4·54					
		1940^1	1939	1·79	34·70	27·77	2·51	—	—	74·7	3·99					
1468	5	0	—	1·20	33·97	27·23	2·03	—	0·14	17·2	7·43	**N 70 V**	50–0	2113		
		10	—	1·20	33·97	27·23	2·07	—	0·14	17·9	—	,,	100–50			
		20	—	1·20	33·97	27·23	2·07	—	0·13	18·2	7·44	,,	250–100			
		30	—	1·20	33·97	27·23	2·07	—	0·14	18·2	—	,,	500–250			
		40	—	1·20	33·97	27·23	2·07	—	0·14	18·1	7·44	,,	750–500			
		50	—	1·21	33·97	27·23	2·09	—	0·14	18·3	—	**NHP**	50–0	—	2219	
		60	—	1·21	33·97	27·23	2·09	—	0·14	18·3	7·38	**N 100 B**	150–0	2234	2254	Depth estimated
		80	—	1·21	33·97	27·23	2·11	—	0·14	17·9	—					
		100	—	1·21	33·97	27·23	2·11	—	0·13	18·2	7·35					
		150	—	1·51	34·00	27·23	2·19	—	0·13	19·7	7·20					
		200	—	1·22	34·03	27·28	2·22	—	0·14	20·5	6·98					
		300	—	1·67	34·14	27·34	2·41	—	0·00	28·3	5·99					
		400	—	2·08	34·25	27·38	2·66	—	0·00	35·7	5·25					
1469	5	0	—	1·11	34·00	27·26	2·13	—	0·13	19·6	7·37	**N 50 V**	100–0	0908		
		10	—	1·09	34·00	27·26	2·00	—	0·14	19·2	—	**N 70 V**	50–0			
		20	—	1·04	34·00	27·26	2·07	—	0·13	19·3	7·36	,,	100–50			
		30	—	1·03	34·00	27·26	2·09	—	0·12	19·3	—	,,	250–100			
		40	—	1·03	34·00	27·26	2·09	—	0·12	19·2	7·37	,,	500–250			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1469 *cont.*	62° 18·9′ S, 95° 52·4′ W	1934 12 xi											
1470	63° 23·9′ S, 95° 40·8′ W	12 xi	2100	4577*	W × N	20	W × N	4	bc	981·0	−1·1	−1·7	mod. conf. W × N swell
1471	64° 44·5′ S, 88° 35·6′ W	13 xi	2000	4570*	Lt airs var.	1–2	W	2	os	976·0	−1·7	−1·7	heavy W swell
1472	66° 31·6′ S, 81° 18·4′ W	14–15 xi	2025	4107*	WNW	15	W	4	c	982·4	−1·1	−1·1	mod. WNW swell
			0000	—	NW	15	NW	4	o	980·6	−1·1	−1·1	mod. conf. NW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σ_t	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1469 *cont.*	5	50	—	1·02	34·00	27·26	2·13	—	0·11	19·3	—	**N 70 V**	750–500			
		60	—	1·02	34·00	27·26	2·13	—	0·11	19·2	7·32	,,	1000–750			
		80	—	1·02	34·00	27·26	2·13	—	0·11	19·3	—	**NHP**	50–0	—	1040	
		100	—	1·02	34·00	27·26	2·13	—	0·11	19·3	7·29	**N 70 B**	104–0	1247	1307	KT
		150	—	1·02	34·00	27·26	2·22	—	0·11	20·0	7·26	**N 100 B**				
		200	—	1·03	34·00	27·26	2·07	—	0·09	20·7	7·24	**N 70 B**	410–200	1247	1317	DGP
		300	—	2·23	34·23	27·36	2·45	—	0·00	32·3	5·48	**N 100 B**				
		400	—	2·46	34·33	27·41	2·64	—	0·00	43·0	4·80					
		600[1]	596	2·44	34·44	27·51	2·70	—	—	49·3	4·20					
		800[1]	—	2·35	34·55	27·61	2·85	—	—	56·7	3·82					
		1000[1]	—	2·25	34·62	27·68	2·78	—	—	64·1	3·81					
		1500[1]	—	2·03	34·72	27·77	2·70	—	—	69·8	3·94					
		2000[1]	2003	1·68	34·74	27·81	2·70	—	—	79·0	4·18					
		2500[2]	2511	1·33	34·75	27·85	2·55	—	—	86·4	4·18					
		3000[2]	—	1·04	34·73	27·85	2·66	—	—	93·6	4·35					
		3500[2]	—	0·77	34·72	27·86	2·47	—	—	101·0	4·46					
		4000[2]	—	0·53	34·72	27·87	2·66	—	—	106·2	4·52					
		4500[2]	4494	0·43	34·71	27·88	2·68	—	—	107·8	4·79					
1470	6	0	—	−0·19	33·98	27·32	1·98	—	0·17	22·9	7·65	**N 50 V**	100–0	**2110**	—	+7 hours
		10	—	−0·19	33·98	27·32	1·98	—	0·17	22·8	—	**N 70 V**	50–0			
		20	—	−0·19	33·98	27·32	1·98	—	0·17	23·9	7·67	,,	100–50			
		30	—	−0·16	33·98	27·32	2·00	—	0·16	23·9	—	,,	250–100			
		40	—	−0·16	33·98	27·32	2·09	—	0·16	23·6	7·61	,,	500–250			
		50	—	−0·16	33·98	27·32	2·11	—	0·16	24·0	—	,,	750–500			
		60	—	−0·16	33·98	27·32	2·11	—	0·16	24·2	7·59	**NHP**	50–0	—	**2215**	
		80	—	−0·16	33·98	27·32	(2·11)	—	0·16	24·0	—	**N 100 B**	73–0	**2234**	**2254**	KT
		100	—	−0·19	33·98	27·32	2·11	—	0·16	24·0	7·55					
		150	—	−0·19	33·98	27·32	2·09	—	0·16	23·9	7·56					
		200	—	0·02	34·02	27·34	2·19	—	0·14	24·7	7·29					
		300	—	1·93	34·30	27·44	2·49	—	0·00	41·1	5·14					
		400	—	2·06	34·37	27·49	2·68	—	0·00	48·2	4·73					
1471	7	0	—	−0·61	33·86	27·23	2·09	—	0·21	20·0	7·67	**N 50 V**	100–0	2008	—	+6 hours
		10	—	−0·48	33·89	27·25	2·09	—	0·21	20·0	—	**N 70 V**	50–0			
		20	—	−0·47	33·89	27·25	2·09	—	0·21	20·6	7·65	,,	100–50			
		30	—	−0·47	33·89	27·25	2·09	—	0·21	20·2	—	,,	250–100			
		40	—	−0·47	33·89	27·25	2·09	—	0·21	20·3	7·66	,,	500–250			
		50	—	−0·47	33·89	27·25	2·07	—	0·21	20·6	—	,,	750–500			
		60	—	−0·47	33·89	27·25	2·09	—	0·21	20·0	7·58	**NHP**	50–0	—	**2105**	
		80	—	−0·47	33·89	27·25	2·09	—	0·21	20·2	—	**N 70 B**	168–0	**2127**	**2147**	KT
		100	—	−0·47	33·90	27·26	2·09	—	0·21	20·0	7·58	**N 100 B**				
		150	—	−0·47	33·91	27·27	2·09	—	0·21	20·9	7·57					
		200	—	1·12	34·12	27·35	2·38	—	0·00	28·8	6·29					
		300	—	2·03	34·29	27·42	2·55	—	0·00	33·4	5·07					
		400	—	2·26	34·40	27·49	2·74	—	0·00	44·6	4·48					
1472	8	0	—	−1·75	33·89	27·29	2·13	34·27	0·22	24·6	7·72	**N 50 V**	100–0	**2033**		
		5	—	−1·75	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·75	33·89	27·29	2·13	—	0·22	27·6	—	,,	100–50			
		20	—	−1·75	33·89	27·29	2·13	34·98	0·21	28·2	7·72	,,	250–100			
		30	—	−1·75	33·89	27·29	2·13	—	0·22	28·4	—	,,	500–250			
		40	—	−1·75	33·89	27·29	2·13	34·98	0·21	28·2	7·70	,,	750–500			
		50	—	−1·75	33·90	27·30	2·13	—	0·21	28·3	—	,,	1000–750			
		60	—	−1·74	33·91	27·31	2·13	35·70	0·21	28·4	7·68	**NHP**	50–0	—	**2200**	
		80	—	−1·71	33·94	27·33	2·20	36·41	0·21	28·6	—	**CWS**	0			
		100	—	−1·59	33·96	27·35	2·34	36·41	0·21	28·3	7·41	,,	5			
		150	—	0·21	34·20	27·47	2·76	37·84	0·07	38·3	5·98	,,	10			
		200	—	1·57	34·41	27·55	2·78	39·26	0·00	46·8	4·66	,,	20			
		300	—	2·03	34·54	27·63	2·81	—	0·00	55·5	4·07	,,	50			
		400	—	2·06	34·59	27·66	2·78	41·41	0·00	60·1	3·94	,,	100			
		600[1]	604	2·07	34·66	27·71	2·78	38·55	—	66·0	3·88	**N 70 B**	98–0	**0009**	**0029**	KT
		800[1]	—	2·00	34·72	27·77	2·76	39·26	—	69·5	3·97	**N 100 B**				
		1000[1]	—	1·89	34·74	27·80	2·76	40·69	—	72·9	4·05	**N 100 H**	0–5	**0009**	**0039**	
		1490[2]	1490	1·52	34·75	27·84	2·72	37·84	—	79·3	4·33	**N 70 B**	340–240	**0009**	**0040**	DGP
		1990[3]	1988	1·16	34·75	27·86	2·62	—	—	87·5	4·37	**N 100 B**				
		2490[3]	—	0·88	34·74	27·87	2·64	37·84	—	93·4	4·45					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1472 *cont.*	66° 31·6′ S, 81° 18·4′ W	1934 14–15 xi											
1473	63° 47·5′ S, 80° 40·2′ W	15 xi	2000	4371*	N	15	N	2	osp	986·4	−0·6	−0·6	low N swell
1474	62° 49·9′ S, 80° 28·3′ W	16 xi	0900	4556*	N	18	N	4	omd	980·8	1·7	1·4	mod. N swell
1475	62° 05′ S, 80° 19′ W	16 xi	2000	4709*	N	17	N	4	omd	963·6	2·8	2·8	mod. N swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S °/₀₀	σt	Mg.—atom m.³				O₂ c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N₂	Nitrite N₂	Si				From	To	
1472 *cont.*	8	2990^3	—	0·64	34·73	27·87	2·66	—	—	101·0	4·46					
		3490^3	—	0·45	34·72	27·88	2·72	38·55	—	102·6	4·60					
		3990^3	3994	0·35	34·71	27·88	2·72	—	—	116·7	4·74					
1473	9	0	—	−1·15	33·82	27·23	2·11	27·84	0·29	17·8	7·95	**N 50 V**	100–0	**2005**		
		5	—	−1·15	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·16	33·82	27·23	2·11	—	0·31	19·1	—	,,	100–50			
		20	—	−1·16	33·82	27·23	2·11	24·27	0·31	18·9	7·96	,,	250–100			
		30	—	−1·16	33·82	27·23	2·11	—	0·31	19·3	—	,,	500–250			
		40	—	−1·16	33·82	27·23	2·11	25·70	0·31	19·3	7·96	,,	750–500			
		50	—	−1·18	33·83	27·24	2·11	—	0·31	19·2	—	,,	1000–750			
		60	—	−1·21	33·83	27·24	2·11	26·41	0·30	19·6	7·87	**NHP**	50–0	—	**2127**	
		80	—	−1·27	33·84	27·24	2·11	26·41	0·29	19·4	—	**CWS**	0			
		100	—	−1·39	33·85	27·25	2·11	—	0·29	20·5	7·81	,,	5			
		150	—	−0·67	34·01	27·36	2·30	27·13	0·14	26·2	7·05	,,	10			
		200	—	1·78	34·24	27·41	2·45	28·56	0·00	40·1	5·35	,,	20			
		300	—	2·23	34·40	27·49	2·53	—	0·00	44·8	4·51	,,	50			
		400	—	2·24	34·45	27·53	2·62	31·41	0·00	49·7	4·25	,,	100			
		600^1	607	2·23	34·58	27·64	2·72	27·84	—	63·1	3·88	**N 70 B**	110–0	**2253**	**2313**	KT
		800^1	—	2·21	34·65	27·69	2·72	31·41	—	70·9	3·84	**N 100 B**				
		1000^1	—	2·12	34·70	27·75	2·72	29·98	—	73·6	3·96	**N 70 B**	410–200	**2253**	**2323**	DGP
		1500^1	1492	1·81	34·74	27·80	2·72	28·56	—	80·7	4·12	**N 100 B**				
		2000^2	2007	1·44	34·75	27·84	2·72	—	—	90·4	4·14	**N 100 H**	0–5	**2253**	**2323**	
		2500^2	—	1·13	34·74	27·85	2·72	28·56	—	94·5	4·38					
		3000^2	—	0·84	34·73	27·86	2·60	—	—	102·6	4·50					
		3500^2	—	0·55	34·73	27·88	2·66	34·98	—	104·2	4·53					
		4000^2	4007	0·44	34·71	27·88	2·72	—	—	109·4	4·61					
1474	9	0	—	−0·82	33·85	27·24	1·98	—	0·29	19·2	7·88	**N 50 V**	100–0	0906		
		5	—	−0·85	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·86	33·85	27·24	1·82	—	0·29	19·3	—	,,	100–50			
		20	—	−0·86	33·85	27·24	1·84	—	0·29	19·1	7·90	,,	250–100			
		30	—	−0·87	33·85	27·24	1·81	—	0·29	19·0	—	,,	500–250			
		40	—	−0·87	33·85	27·24	1·81	—	0·29	19·4	7·87	,,	750–500			
		50	—	−0·87	33·85	27·24	1·81	—	0·29	19·2	—	,,	1000–750			
		60	—	−0·94	33·85	27·24	1·88	—	0·29	19·2	7·81	**NHP**	50–0	—	1028	
		80	—	−0·98	33·85	27·24	1·84	—	0·30	19·3	—	**CWS**	0			
		100	—	−0·92	33·85	27·24	1·98	—	0·29	19·2	7·77	,,	5			
		150	—	−0·77	33·86	27·23	2·01	—	0·29	20·0	7·64	,,	10			
		200	—	0·37	34·04	27·33	2·24	—	0·00	28·6	6·65	,,	20			
		295	—	1·84	34·25	27·40	2·43	—	0·00	42·2	5·22	,,	50			
		395	—	2·17	34·37	27·48	2·55	—	0·00	49·3	4·56	,,	100			
		590^1	584	2·34	34·50	27·56	2·64	—	—	59·4	3·85	**N 70 B**	95–0	1051	1111	KT
		790^1	—	2·23	34·59	27·65	2·74	—	—	65·9	3·78	**N 100 B**				
		990^1	—	2·17	34·67	27·71	2·68	—	—	72·3	3·84	**N 70 B**	360–230	1051	1121	DGP
		1480^1	—	1·90	34·74	27·80	2·64	—	—	73·9	4·00	**N 100 B**				
		1970^1	1976	1·57	34·75	27·83	2·64	—	—	85·7	4·18					
1475	10	0	—	0·40	33·94	27·25	1·82	19·99	0·24	17·7	7·60	**N 50 V**	100–0	**2010**		
		5	—	0·39	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·37	33·94	27·25	1·82	—	0·25	18·3	—	,,	100–50			
		20	—	0·36	33·94	27·25	1·84	29·27	0·24	18·4	7·61	,,	250–100			
		30	—	0·36	33·94	27·25	1·79	—	0·24	18·8	—	,,	500–250			
		40	—	0·36	33·94	27·25	1·96	37·12	0·24	19·0	7·60	,,	750–500			
		50	—	0·32	33·94	27·25	1·96	—	0·24	19·1	—	,,	1000–750			
		60	—	0·31	33·94	27·25	2·01	35·70	0·24	18·9	7·54	**NHP**	50–0	—	**2130**	
		80	—	0·31	33·94	27·25	2·01	35·70	0·24	19·4	—	**CWS**	0			
		100	—	0·28	33·94	27·26	2·01	34·98	0·24	19·6	7·50	,,	5			
		150	—	0·21	33·94	27·26	2·01	30·70	0·24	19·7	7·49	,,	10			
		200	—	0·21	33·95	27·27	2·13	37·12	0·21	20·5	7·33	,,	20			
		295	—	1·46	34·15	27·36	2·32	—	0·00	32·5	6·02	,,	50			
		395	—	2·14	34·30	27·42	2·57	42·83	0·00	39·1	4·94	,,	100			
		590^1	583	2·37	34·46	27·53	2·81	46·40	—	50·4	4·12	**N 100 B**	115–0	**2319**	**2339**	KT
		790^1	—	2·34	34·56	27·61	2·81	44·26	—	58·3	3·86	**N 70 B**	430–230	**2319**	**2349**	DGP
		990^1	—	2·26	34·63	27·68	2·70	47·12	—	64·4	3·83	**N 100 B**				
		1480^1	1487	2·05	34·74	27·78	2·66	37·84	—	74·4	4·01					
		1970^2	1964	1·71	34·75	27·82	2·49	—	—	81·2	4·13					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1475 *cont.*	62° 05′ S, 80° 19′ W	1934 16 xi											
1476	60° 20·7′ S, 79° 53·9′ W	17 xi	1600	4947*	NW × W	14	NW	5	bc	984·2	2·8	1·3	mod. conf. NW swell
1477	58° 27·6′ S, 59° 56·8′ W	4 xii	2000	3409*	W × N	22	W × N	5	bc	982·9	2·3	1·7	heavy conf. W × S swell
1478	61° 14·8′ S, 61° 20·9′ W	5 xii	2000	3606*	NW × W	14	NW × W	3	c	978·2	0·9	0·4	heavy conf. W swell
1479	Yankee Harbour, Greenwich I, S Shetland Is	13 xii	2000	—	Lt airs	0–1	—	—	c	963·4	1·9	0·3	—
1480	Harmony Cove, Nelson I, S Shetland Is	14 xii	1200	—	SW	16	SW	3	bc	972·5	4·6	2·2	—
		15 xii	1200	—	W × S	8	W × S	3	c	979·2	2·3	1·1	—
1481	Visca Anchorage, Admiralty Bay, King George I, S Shetland Is	17 xii	1200	—	Lt airs	0–1	—	—	b	988·5	3·9	1·1	—
		18 xii	1200	—	SW × W	3	SW × W	2	c	996·3	2·8	0·2	
		19 xii	1200	—	W × N	4	W × N	2	os	999·2	0·6	0·0	
1482	No Good Inlet, Fildes Strait, S Shetland Is	18 xii	2000	—	W	10	W	2	c	997·3	1·1	0·0	—
1483	Fildes Strait, S Shetland Is	21 xii	2000	—	WSW	16	WSW	2	c	986·3	0·0	– 1·1	—
1484	Whalers Bay, Deception I, S Shetland Is	24 xii	1600	—	—	—	—	—	bc	983·7	4·1	1·4	—
1485	Coppermine Cove, Roberts I, S Shetland Is	31 xii	1600	—	W	10	W	2	c	1005·9	1·9	1·4	—
1486	Harmony Cove, Nelson I, S Shetland Is	1935 4 i	1200	—	W × S	20	W × S	3	c	994·8	1·7	0·0	—
1487	Desolation I, Livingston I, S Shetland Is	8 i	1600	—	—	0–1	—	—	c	1005·8	2·8	0·6	—
1488	South side of Neptune's Bellows, Deception I, S Shetland Is	10 i	1600	—	WSW	10	—	1	b	998·8	3·9	0·8	—

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.-atom m.³				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1475 *cont.*		2460^2	—	1·37	34·74	27·84	2·53	37·12	—	86·3	4·22					
		2960^2	—	1·06	34·74	27·86	2·57	—	—	94·9	4·37					
		3450^2	—	0·78	34·73	27·87	2·66	44·26	—	100·3	4·35					
		3940^2	3949	0·56	34·73	27·88	2·66	—	—	111·7	4·52					
1476	10	0	—	2·73	34·09	27·20	1·90	—	0·16	15·1	7·06	**N 50 V**	100–0	1606		
		5	—	2·73	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	2·73	34·09	27·20	1·67	—	0·16	14·3	—	,,	100–50			
		20	—	2·73	34·09	27·20	1·98	—	0·16	15·1	7·08	,,	250–100			
		30	—	2·73	34·09	27·20	1·84	—	0·16	15·3	—	,,	500–250			
		40	—	2·73	34·09	27·20	1·71	—	0·16	15·1	7·06	,,	750–500			
		50	—	2·73	34·09	27·20	1·79	—	0·16	14·9	—	,,	1000–750			
		60	—	2·72	34·09	27·20	1·82	—	0·16	14·8	7·00	**NHP**	50–0	—	1716	
		80	—	2·72	34·09	27·20	1·81	—	0·16	14·9	—	**CWS**	0			
		100	—	2·71	34·09	27·20	1·86	—	0·16	15·2	7·00	,,	5			
		150	—	2·52	34·09	27·22	1·96	—	0·16	15·1	6·98	,,	10			
		200	—	2·55	34·09	27·22	1·82	—	0·26	16·0	6·88	,,	20			
		300	—	2·94	34·19	27·27	1·96	—	0·00	20·4	5·94	,,	50			
		400	—	2·15	34·13	27·28	2·07	—	0·00	22·7	6·16	,,	100			
		590^1	600	2·60	34·30	27·38	2·55	—	—	35·6	4·97	**N 70 B** **N 100 B**	88–0	1913	**1933**	KT
		790^1	—	2·60	34·45	27·50	2·72	—	—	49·0	4·16					
		990^1	—	2·56	34·54	27·58	2·74	—	—	56·0	3·84	**N 70 B**	350–210	1913	**1943**	DGP
		1480^1	—	2·23	34·69	27·72	2·55	—	—	63·7	3·84	**N 100 B**	350–0	1913	**1956**	DGP
		1980^1	1971	1·96	34·74	27·79	2·55	—	—	74·7	4·04					
		2500^2	2497	1·60	34·75	27·83	2·53	—	—	80·4	4·14					
		3000^2	—	1·27	34·75	27·85	2·53	—	—	89·3	4·30					
		3500^2	—	0·97	34·74	27·86	2·53	—	—	97·8	4·32					
		4000^2	—	0·67	34·74	27·88	2·59	—	—	103·6	4·49					
1477	28	0	—	0·62	34·04	27·32	—	—	—	—	—	**N 50 V**	100–0	2000	—	+3 hours
												NHP	50–0	—	2017	
1478	29	0	—	0·10	34·00	27·31	—	—	—	—	—	**N 50 V**	100–0	2004		
												NHP	50–0	—	2014	
1479	—	—	—	—	—	—	—	—	—	—	—	**Sh. Coll.**				
1480	—	—	—	—	—	—	—	—	—	—	—	**Sh. Coll.**				
	—	—	—	—	—	—	—	—	—	—	—	**Sh. Coll.**				
1481	—	—	—	—	—	—	—	—	—	—	—	**Sh. Coll.**				
1482	—	—	—	—	—	—	—	—	—	—	—	**Sh. Coll.**				
1483	—	—	—	—	—	—	—	—	—	—	—	**Sh. Coll.**				
1484	—	—	—	—	—	—	—	—	—	—	—	**Sh. Coll.**				
1485	—	—	—	—	—	—	—	—	—	—	—	**Sh. Coll.**				
1486	—	—	—	—	—	—	—	—	—	—	—	**Sh. Coll.**				
1487	—	—	—	—	—	—	—	—	—	—	—	**Sh. Coll.**				
1488	—	—	—	—	—	—	—	—	—	—	—	**Sh. Coll.**				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1489	Port Lockroy, Wiencke I, Palmer Archipelago	1935 17 i	1200	—	—	—	—	—	bc	990·5	7·6	5·6	—
		18 i	1200	—	Lt airs	0–1	—	1	c	995·9	7·9	4·5	
1490	C Roquemaurel, Trinity Peninsula, Graham Land	20 i	0800	—	NE	8	NE	2	bc	1002·6	7·5	4·7	—
1491	59° 15·7′ S, 43° 36·4′ W	23 i	0900	3628*	SSW	12	S × W	3–4	bc	1001·0	2·2	0·0	mod. S × W swell
			1300	—	SW × S	14	S × W	3–4	bc	1001·4	2·2	0·0	mod. conf. SSW swell
1492	57° 56·2′ S, 43° 48·5′ W	23 i	2130	2427*	WSW	10	WSW	2	o	1002·6	1·4	0·5	low conf. swell
1493	54° 54·4′ S, 44° 03·9′ W	24 i	2000	3747*	W	10	W	3	od	995·5	2·8	2·6	low W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS					Mg.—atom m.^{3}					BIOLOGICAL OBSERVATIONS		TIME		Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1489	—	—	—	—	—	—	—	—	—	—	—	**Sh. Coll.**				
1490	—	—	—	—	—	—	—	—	—	—	—	**Sh. Coll.**				
1491	18	0	—	1·61	34·11	27·31	1·39	—	0·34	10·5	7·62	**N 50 V**	100–0	0907	—	+4 hours
		5	—	1·60	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	1·59	34·11	27·31	1·39	—	0·24	11·2	—	,,	100–50			
		20	—	1·59	34·11	27·31	1·39	—	0·23	12·0	7·64	,,	250–100			
		30	—	1·50	34·11	27·32	1·43	—	0·23	11·9	—	,,	500–250			
		40	—	1·50	34·11	27·32	1·44	—	0·23	13·0	7·57	,,	750–500			
		50	—	1·50	34·11	27·32	1·46	—	0·23	12·6	—	,,	1000–750			
		60	—	1·31	34·15	27·37	1·54	—	0·23	20·3	7·41	**NHP**	50–0	—	1032	
		80	—	0·18	34·31	27·56	2·60	—	0·19	48·7	—	**CWS**	0			
		100	—	0·19	34·33	27·57	2·60	—	0·19	55·7	6·49	,,	5			
		150	—	0·25	34·40	27·63	2·60	—	0·31	61·7	6·05	,,	10			
		200	—	0·71	34·49	27·67	2·60	—	0·00	57·3	5·07	,,	20			
		300	—	1·08	34·59	27·74	2·60	—	0·00	62·5	4·62	,,	50			
		400	—	1·44	34·67	27·77	2·59	—	0·00	67·6	4·38	,,	100			
		590[1]	592	1·29	34·69	27·79	2·60	—	—	74·0	4·36	**N 70 B**	109–0	1258	1318	KT
		790[1]	—	1·24	34·70	27·81	2·60	—	—	78·9	4·28	**N 100 B**				
		990[1]	—	1·05	34·70	27·83	2·60	—	—	87·4	4·38	**N 70 B**	420–240	1258	1328	DGP
		1500[2]	1501	0·63	34·70	27·85	2·64	—	—	95·2	4·62	**N 100 B**				
		2000[2]	—	0·39	34·69	27·85	2·66	—	—	82·9	4·65					
		2500[2]	—	0·13	34·68	27·86	2·64	—	—	88·7	4·85					
		3000[2]	—	−0·19	34·67	27·87	2·60	—	—	87·1	5·30					
		3500[2]	3491	−0·31	34·67	27·88	2·60	—	—	91·1	5·29					
1492	19	0	—	1·70	34·16	27·34	1·35	—	0·21	10·5	7·61	**N 100 B**	180–0	**2143**	**2203**	KT
		5	—	1·70	—	—	—	—	—	—	—	**N 50 V**	100–0	**2216**		
		10	—	1·69	34·16	27·34	1·37	—	0·21	11·2	—	**N 70 V**	50–0			
		20	—	1·61	34·16	27·35	1·37	—	0·21	10·7	7·61	,,	100–50			
		30	—	1·54	34·16	27·36	1·37	—	0·21	11·3	—	,,	250–100			
		40	—	1·52	34·16	27·36	1·39	—	0·21	11·6	7·55	,,	500–250			
		50	—	1·51	34·16	27·36	1·37	—	0·21	13·4	—	,,	750–500			
		60	—	0·60	34·21	27·46	2·13	—	0·19	36·8	7·16	,,	1000–750			
		80	—	0·00	34·27	27·54	2·45	—	0·19	51·9	—	**NHP**	50–0	—	**2338**	
		100	—	−0·30	34·29	27·57	2·55	—	0·19	57·9	6·86	**CWS**	0			
		150	—	0·11	34·41	27·64	2·57	—	0·29	63·3	5·84	,,	5			
		195	—	0·28	34·50	27·70	2·55	—	0·00	65·3	5·42	,,	10			
		290	—	0·93	34·60	27·75	2·55	—	0·00	69·3	4·73	,,	20			
		390	—	1·14	34·65	27·77	2·55	—	0·00	72·9	4·55	,,	50			
		580[1]	577	1·10	34·69	27·80	2·55	—	—	80·8	4·43	,,	100			
		780[1]	—	0·99	34·70	27·83	2·55	—	—	88·6	4·41					
		970[1]	—	0·89	34·70	27·84	2·53	—	—	89·4	4·51					
		1460[1]	—	0·42	34·69	27·85	2·62	—	—	98·2	4·64					
		1940[1]	1948	0·10	34·69	27·86	2·62	—	—	100·3	4·88					
1493	20	0	—	3·08	33·88	27·01	1·50	—	0·24	6·3	7·30	**N 50 V**	100–0	**2011**		
		5	—	3·08	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	3·08	33·88	27·01	1·50	—	0·23	6·3	—	,,	100–50			
		20	—	3·08	33·88	27·01	1·50	—	0·23	6·9	7·31	,,	250–100			
		30	—	3·07	33·88	27·01	1·50	—	0·23	7·0	—	,,	500–250			
		40	—	3·03	33·88	27·02	1·54	—	0·22	7·0	7·29	,,	750–500			
		50	—	3·02	33·88	27·02	1·54	—	0·22	7·7	—	,,	1000–750			
		60	—	2·99	33·89	27·02	1·62	—	0·22	8·2	7·22	**NHP**	50–0	—	**2132**	
		80	—	0·78	33·94	27·23	2·07	—	0·28	18·3	—	**CWS**	0			
		100	—	0·89	33·96	27·24	2·09	—	0·29	20·0	7·26	,,	5			
		150	—	1·33	34·05	27·28	2·17	—	0·09	22·4	6·60	,,	10			
		200	—	1·94	34·17	27·34	2·36	—	0·00	24·8	5·88	,,	20			
		300	—	2·07	34·24	27·39	2·53	—	0·00	35·3	5·14	,,	50			
		400	—	2·41	34·37	27·46	2·70	—	0·00	45·1	4·37	,,	100			
		600[1]	597	2·19	34·51	27·58	2·76	—	—	55·3	3·95	**N 70 B**	103–0	**2243**	**2303**	KT
		800[1]	—	2·21	34·62	27·68	2·76	—	—	62·5	3·86	**N 100 B**				
		1000[1]	1000	2·09	34·70	27·75	2·76	—	—	69·2	3·83	**N 70 B**	420–220	**2243**	**2313**	DGP
		1500[2]	1511	1·73	34·73	27·80	2·72	—	—	75·9	4·08	**N 100 B**				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1493 *cont.*	54° 54·4′ S, 44° 03·9′ W	1935 24 i											
1494	53° 30·8′ S, 44° 03·6′ W	25 i	0900	1639*	W × S	12	W × S	3	om	999·0	3·9	3·6	mod W × S swell
1495	52° 05·6′ S, 44° 05·3′ W	25 i	2000	2933*	W	10	W	2	bc	1005·0	4·7	4·3	low W swell
1496	53° 55·4′ S, 40° 28·9′ W	26–27 i	2315	1686*	NNW	18	NNW	4	omd	979·7	4·1	4·0	mod. NNE swell
1497	53° 54·7′ S, 39° 49·9′ W	27 i	0357	448*	NW × N	18	NW × N	4	od	979·9	3·9	3·3	mod. NW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O^2 c.c. litre	Gear	Depth (metres)	From	To	
1493	20	2000^2	—	1·28	34·72	27·82	2·68	—	—	84·7	4·30					
cont.		2500^2	—	0·82	34·70	27·84	2·68	—	—	90·2	4·64					
		3000^2	—	0·48	34·69	27·84	2·76	—	—	89·3	4·66					
		3500^2	3495	0·32	34·69	27·85	2·76	—	—	96·2	4·85					
1494	20	0	—	3·07	33·89	27·01	1·46	—	0·26	<4·2	7·34	**N 50 V**	100–0	0908		
		5	—	3·06	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	3·05	33·90	27·03	1·46	—	0·26	<4·2	—	,,	100–50			
		20	—	3·05	33·91	27·04	1·46	—	0·26	<4·3	7·35	,,	250–100			
		30	—	2·99	33·91	27·04	1·46	—	0·26	<4·3	—	,,	500–250			
		40	—	2·94	33·91	27·05	1·46	—	0·26	<4·2	7·29	,,	750–500			
		50	—	2·91	33·91	27·05	1·48	—	0·25	<4·0	—	,,	1000–750			
		60	—	2·21	33·92	27·12	1·71	—	0·24	10·0	7·22	**NHP**	50–0	—	1028	
		80	—	1·12	33·99	27·25	2·03	—	0·27	21·8	—	**CWS**	0			
		100	—	0·97	34·04	27·29	2·05	—	0·30	22·9	7·13	,,	5			
		150	—	0·98	34·08	27·33	2·22	—	0·22	27·8	6·54	,,	10			
		200	—	1·21	34·15	27·38	2·30	—	0·21	33·9	5·99	,,	20			
		300	—	2·04	34·42	27·52	2·66	—	0·00	51·5	4·45	,,	50			
		400	—	2·05	34·50	27·59	2·70	—	0·00	53·6	4·19	,,	100			
		600^1	593	2·10	34·60	27·66	2·62	—	—	60·7	3·81	**N 70 B**	110–0	1038	1058	KT
		790^1	—	2·02	34·68	27·74	2·66	—	—	68·5	3·99	**N 100 B**				
		990^1	—	1·89	34·70	27·77	2·66	—	—	76·9	3·91					
		1490^1	1495	1·33	34·72	27·82	2·66	—	—	81·9	4·16					
1495	21	0	—	4·33	33·99	26·98	1·44	—	0·21	<4·2	7·04	**N 50 V**	100–0	**2008**		
		5	—	4·33	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	4·33	33·99	26·98	1·43	—	0·21	<4·2	—	,,	100–50			
		20	—	4·32	33·99	26·98	1·41	—	0·22	<4·2	7·04	,,	250–100			
		30	—	4·31	33·99	26·98	1·44	—	0·21	<4·2	—	,,	500–250			
		40	—	4·13	33·99	27·00	1·43	—	0·22	<4·1	6·97	,,	750–500			
		50	—	4·10	33·99	27·00	1·43	—	0·21	6·2	—	,,	1000–750			
		60	—	3·95	33·99	27·02	1·60	—	0·21	6·4	6·92	**NHP**	50–0	—	**2124**	
		80	—	3·15	34·06	27·15	1·82	—	0·37	13·2	—	**CWS**	0			
		100	—	2·93	34·07	27·17	1·84	—	0·18	14·3	6·74	,,	5			
		150	—	2·27	34·05	27·21	1·84	—	0·00	17·5	6·60	,,	10			
		200	—	2·15	34·09	27·25	2·13	—	0·00	18·4	6·34	,,	20			
		295	—	2·55	34·22	27·32	2·49	—	0·00	30·9	5·25	,,	50			
		395	—	2·65	34·32	27·40	2·57	—	0·00	38·5	4·69	,,	100			
		590	—	2·55	34·43	27·50	2·57	—	—	50·4	4·04	**N 70 B**	88–0	**2147**	**2207**	KT
		790^1	791	2·35	34·56	27·61	2·62	—	—	60·4	3·73	**N 100 B**				
		980^1	—	2·22	34·61	27·67	2·62	—	—	64·8	3·70	**N 70 B**	330–170	**2147**	**2217**	DGP
		1480^1	—	1·99	34·69	27·74	2·57	—	—	73·3	3·99	**N 100 B**				
		1970^1	—	1·65	34·72	27·80	2·59	—	—	80·2	4·09					
		2460^1	2458	1·25	34·71	27·82	2·59	—	—	93·3	4·28					
1496	22	0	—	2·40	33·93	27·10	1·20	—	—	8·5	7·23	**N 70 B**	159–0	**2326**	**2346**	KT
		5	—	2·40	—	—	—	—	—	—	—	**N 100 B**				
		10	—	2·40	33·93	27·10	1·24	—	—	8·4	—	**N 50 V**	100–0	**0006**		
		20	—	2·40	33·93	27·10	1·22	—	—	8·5	7·23	**N 70 V**	50–0			
		30	—	2·40	33·93	27·10	1·22	—	—	9·1	—	,,	100–50			
		40	—	2·40	33·93	27·10	1·22	—	—	9·1	7·22	,,	250–100			
		50	—	2·40	33·93	27·10	1·29	—	—	9·0	—	,,	500–250			
		60	—	2·32	33·95	27·13	1·29	—	—	9·2	7·21	,,	750–500			
		80	—	1·50	33·98	27·22	1·37	—	—	11·7	—	,,	1000–750			
		100	—	0·48	33·99	27·29	1·50	—	—	22·1	7·28	**NHP**	50–0	—	**0114**	
		150	—	0·43	34·10	27·38	1·56	—	—	30·2	6·56	**CWS**	0			
		195	—	1·14	34·25	27·45	1·77	—	—	41·3	5·46	,,	5			
		295	—	1·81	34·45	27·56	1·90	—	—	49·9	4·44	,,	10			
		390	—	2·14	34·54	27·62	1·75	—	—	56·9	4·05	,,	20			
		590^1	585	2·06	34·67	27·72	1·98	—	—	59·9	3·81	,,	50			
		780^1	—	2·00	34·69	27·74	1·92	—	—	69·6	3·94	,,	100			
		980^1	—	1·79	34·71	27·78	1·92	—	—	72·2	3·99					
		1470^1	1470	1·31	34·72	27·82	1·96	—	—	78·4	4·25					
1497	22	0	—	2·64	33·93	27·08	1·46	—	—	9·4	7·27	**N 70 B**	90–0	0404	0424	
		5	—	2·62	—	—	—	—	—	—	—	**N 100 B**				
		10	—	2·62	33·93	27·08	1·46	—	—	8·5	—	**N 50 V**	100–0	0506		

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1497 *cont.*	53° 54·7′ S, 39° 49·9′ W	1935 27 i											
1498	53° 54·1′ S, 39° 16·5′ W	27 i	0800	221*	W × N	18	W × N	4	o	982·4	3·9	3·3	mod. conf. W × N swell
1499	53° 53·5′ S, 38° 41·1′ W	27 i	1150	199*	NW × W	12	NW × W	4	c	982·8	3·9	2·9	mod. WNW swell
1500	3 miles S 60° E from Jason I S Georgia	3 ii	1713	—	NW	25	NW	4	om	995·3	3·9	3·2	mod. NW swell
1501	52° 43·7′ S, 36° 57·9′ W	5 ii	0200	1781*	W	25	W	5	bc	1003·9	2·8	1·4	heavy conf. W swell
1502	53° 03·6′ S, 36° 58·5′ W	5 ii	0734	2569*	W × S	24	W × S	6	bc	1007·7	3·0	1·7	heavy conf. W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom $m.^3$							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1497 *cont.*	22	20	—	2·64	33·93	27·08	1·56	—	—	8·4	7·22	N 70 V	50–0			
		30	—	2·63	33·93	27·08	1·54	—	—	8·5	—	,,	100–50			
		40	—	2·32	33·93	27·11	1·52	—	—	8·5	7·31	,,	250–100			
		50	—	1·79	33·95	27·17	1·62	—	—	14·2	—	,,	400–250			
		60	—	1·61	33·96	27·19	1·69	—	—	15·7	7·26	NHP	50–0	—	0550	
		80	—	0·82	33·98	27·26	1·86	—	—	19·4	—	CWS	0			
		100	—	0·38	33·99	27·30	1·88	—	—	24·1	7·23	,,	5			
		150	—	0·73	34·03	27·31	2·09	—	—	32·1	6·63	,,	10			
		200	—	0·91	34·14	27·39	2·19	—	—	35·7	6·00	,,	20			
		300	—	1·54	34·33	27·48	2·57	—	—	47·5	4·80	,,	50			
		400	—	1·89	34·43	27·55	2·60	—	—	59·9	4·20	,,	100			
1498	22	0	—	2·25	33·89	27·08	1·50	—	—	23·3	7·24	N 70 B	128–0	0807	0827	KT
		5	—	2·25	—	—	—	—	—	—	—	N 100 B				
		10	—	2·24	33·89	27·08	1·48	—	—	23·1	—	N 50 V	100–0	0845		
		20	—	2·24	33·89	27·08	1·60	—	—	23·2	7·24	N 70 V	50–0			
		30	—	2·22	33·89	27·09	1·60	—	—	23·2	—	,,	100–50			
		40	—	2·22	33·89	27·09	1·63	—	—	23·6	7·22	,,	175–100			
		50	—	2·22	33·89	27·09	1·65	—	—	23·6	—	NHP	50–0	—	0910	
		60	—	2·17	33·89	27·09	1·65	—	—	23·6	7·20	CWS	0			
		80	—	1·71	33·94	27·16	1·71	—	—	24·4	—	,,	5			
		100	—	1·32	33·97	27·22	1·90	—	—	29·4	6·89	,,	10			
		150	—	0·85	34·14	27·39	2·32	—	—	37·8	6·13	,,	20			
		200	—	1·16	34·23	27·44	2·53	—	—	51·8	5·43	,,	50			
												,,	100			
1499	22	0	—	2·33	33·86	27·05	1·39	—	—	22·0	7·37	N 70 B	139–0	1158	1218	KT. +3 hours 30 minutes
		5	—	2·33	—	—	—	—	—	—	—	N 100 B				
		10	—	2·32	33·86	27·05	1·37	—	—	22·4	—	N 50 V	100–0	1228		
		20	—	2·32	33·86	27·05	1·39	—	—	22·2	7·25	N 70 V	50–0			
		30	—	2·23	33·86	27·06	1·39	—	—	22·3	—	,,	100–50			
		40	—	2·05	33·89	27·10	1·41	—	—	22·3	7·17	,,	170–100			
		50	—	1·73	33·93	27·15	1·46	—	—	22·8	—	NHP	50–0	—	1254	
		60	—	1·70	33·93	27·15	1·60	—	—	23·1	7·07	CWS	0			
		80	—	1·18	33·99	27·25	1·88	—	—	28·8	—	,,	5			
		100	—	0·90	34·02	27·29	2·07	—	—	31·9	6·81	,,	10			
		150	—	0·81	34·08	27·34	2·28	—	—	36·7	6·17	,,	20			
												,,	50			
												,,	100			
1500	29	0	—	2·90	33·54	26·75	—	—	—	—	—	N 50 V	100–0	1715	1720	+0 hours 50 minutes
1501	1	0	—	2·45	33·95	27·12	1·44	—	—	8·3	7·30	N 100 B	148–0	**0226**	**0246**	KT
		5	—	2·45	—	—	—	—	—	—	—	N 70 V	50–0			
		10	—	2·45	33·95	27·12	1·44	—	—	8·4	—	,,	100–50			
		20	—	2·45	33·95	27·12	1·44	—	—	8·4	7·27	,,	250–100			
		30	—	2·45	33·95	27·12	1·44	—	—	8·3	—	,,	500–250			
		40	—	2·42	33·95	27·12	1·48	—	—	8·5	7·26	,,	750–500			
		50	—	2·36	33·95	27·12	1·50	—	—	9·1	—	,,	1000–750			
		60	—	1·95	33·98	27·19	1·56	—	—	14·0	7·24	NHP	50–0	—	**0421**	
		80	—	0·13	34·04	27·34	1·90	—	—	34·7	—	CWS	0			
		100	—	−0·10	34·07	27·39	1·90	—	—	38·2	7·03	,,	5			
		150	—	0·23	34·22	27·48	2·13	—	—	47·1	5·87	,,	10			
		200	—	1·21	34·42	27·58	2·66	—	—	55·5	4·64	,,	20			
		300	—	1·68	34·54	27·65	2·53	—	—	48·9	4·12	,,	50			
		395	—	1·84	34·60	27·68	2·34	—	—	61·4	4·06	,,	100			
		590[1]	592	1·74	34·66	27·74	2·43	—	—	77·2	4·13					
		790[1]	—	1·59	34·69	27·77	2·45	—	—	69·7	4·02					
		990[1]	—	1·37	34·71	27·82	2·47	—	—	79·5	4·17					
		1480[1]	1484	0·87	34·70	27·84	2·53	—	—	86·1	4·47					
1502	2	0	—	2·45	33·95	27·12	1·29	—	—	7·4	7·23	N 100 B	139–0	0744	0804	KT
		5	—	2·45	—	—	—	—	—	—	—	N 70 V	50–0			
		10	—	2·45	33·95	27·12	1·29	—	—	6·4	—	,,	100–50			
		20	—	2·45	33·95	27·12	1·29	—	—	6·4	7·24	,,	250–100			
		30	—	2·45	33·95	27·12	1·29	—	—	7·1	—	,,	500–250			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1502 *cont.*	53° 03·6′ S, 36° 58·5′ W	1935 5 ii											
1503	53° 24·5′ S, 36° 59·1′ W	5 ii	1215	1898*	W × S	20	W × S	5	b	1009·6	3·9	2·2	heavy conf. W × S swell
1504	53° 41·8′ S, 36° 59·2′ W	5 ii	1628	163*	W × S	18	W × S	4	b	1012·2	4·4	3·1	heavy conf. W × S swell
1505	54° 21′ S, 34° 41·4′ W	7 ii	1254	2701*	NNE	15	NNE	4	om	1007·3	3·6	2·8	mod. conf. NNE swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1502 *cont.*	2	40	—	2·44	33·95	27·12	1·29	—	—	6·4	7·24	**N 70 V**	750–500			
		50	—	2·42	33·96	27·13	1·33	—	—	6·4	—	,,	1000–750			
		60	—	2·19	33·98	27·17	1·41	—	—	10·6	7·15	**NHP**	50–0	—	0948	
		80	—	0·21	34·09	27·38	1·90	—	—	22·2	—	**CWS**	0			
		95	—	0·07	34·14	27·44	1·90	—	—	29·5	6·78	,,	5			
		145	—	0·81	34·28	27·50	2·28	—	—	35·8	5·45	,,	10			
		195	—	1·60	34·43	27·57	2·28	—	—	40·6	4·38	,,	20			
		290	—	1·73	34·52	27·63	2·36	—	—	43·6	4·12	,,	50			
		385	—	1·87	34·60	27·68	2·43	—	—	42·2	4·00	,,	100			
		580^1	563	1·90	34·64	27·72	2·43	—	—	46·1	3·92					
		770^1	—	1·79	34·69	27·75	2·36	—	—	36·5	3·97					
		960^1	—	1·52	34·70	27·80	2·40	—	—	45·3	4·08					
		1440^1	—	1·03	34·71	27·84	2·43	—	—	53·1	4·33					
		1930^1	1940	0·65	34·70	27·85	2·43	—	—	66·0	4·62					
1503	2	0	—	2·40	33·97	27·14	1·35	—	—	9·0	7·16	**N 70 B**	111–0	1221	1241	KT
		5	—	2·40	—	—	—	—	—	—	—	**N 100 B**				
		10	—	2·37	33·97	27·14	1·39	—	—	13·4	—	**N 50 V**	100–0	1256		
		20	—	2·37	33·97	27·14	1·37	—	—	12·5	7·17	**N 70 V**	50–0			
		30	—	2·40	33·97	27·14	1·35	—	—	12·6	—	,,	100–50			
		40	—	2·40	33·97	27·14	1·41	—	—	12·8	7·16	,,	250–100			
		50	—	2·36	33·97	27·14	1·43	—	—	12·2	—	,,	500–250			
		60	—	2·33	33·97	27·15	1·46	—	—	13·0	7·15	,,	750–500			
		80	—	2·31	33·97	27·15	1·48	—	—	14·1	—	,,	1000–750			
		100	—	2·25	33·97	27·15	1·48	—	—	14·0	7·16	**NHP**	50–0	—	1417	
		150	—	−0·04	34·13	27·42	1·86	—	—	39·9	6·56	**CWS**	0			
		200	—	0·71	34·33	27·54	2·26	—	—	51·0	5·31	,,	5			
		300	—	1·62	34·51	27·63	2·53	—	—	60·0	4·21	,,	10			
		395	—	1·83	34·60	27·68	2·51	—	—	64·9	4·02	,,	20			
		590^1	599	1·81	34·65	27·72	2·51	—	—	68·4	4·16	,,	50			
		790^1	—	1·73	34·69	27·76	2·60	—	—	74·2	3·99	,,	100			
		990^1	—	1·58	34·70	27·79	2·60	—	—	73·8	4·05					
		1480^1	1474	1·00	34·69	27·81	2·47	—	—	81·2	4·38					
1504	2	0	—	2·53	33·83	27·02	1·31	—	—	18·5	7·26	**N 70 B**	128–0	1640	1700	KT
		5	—	2·52	—	—	—	—	—	—	—	**N 100 B**				
		10	—	2·52	33·83	27·02	1·44	—	—	18·2	—	**N 50 V**	100–0	1709		
		20	—	2·51	33·83	27·02	1·43	—	—	18·9	7·18	**N 70 V**	50–0			
		30	—	2·49	33·84	27·02	1·39	—	—	18·5	—	,,	100–50			
		40	—	2·38	33·87	27·06	1·44	—	—	18·6	7·16	**NHP**	50–0	—	1738	
		50	—	1·96	33·91	27·13	1·44	—	—	18·5	—	**CWS**	0			
		60	—	1·61	33·98	27·21	1·50	—	—	24·0	7·02	,,	5			
		80	—	1·00	34·04	27·29	1·94	—	—	29·8	—	,,	10			
		100	—	0·98	34·05	27·30	—	—	—	31·2	6·82	,,	20			
												,,	50			
												,,	100			
1505	4	0	—	2·17	33·97	27·16	1·65	—	—	7·0	7·25	**N 50 V**	100–0	1240	1245	+2 hours
		5	—	2·16	—	—	—	—	—	—	—	**N 70 B**	155–0	1259	1319	KT
		10	—	2·15	33·97	27·16	1·63	—	—	6·9	—	**N 100 B**				
		20	—	2·13	33·97	27·16	1·52	—	—	6·9	7·25	**N 50 V**	100–0	1332		
		30	—	2·10	33·97	27·16	1·54	—	—	7·0	—	**N 70 V**	50–0			
		40	—	2·07	33·97	27·17	1·54	—	—	7·0	7·25	,,	100–50			
		50	—	2·00	33·97	27·17	1·56	—	—	8·3	—	,,	250–100			
		60	—	1·96	33·97	27·18	1·60	—	—	8·4	7·20	,,	500–250			
		80	—	1·86	33·97	27·18	1·60	—	—	8·5	—	,,	750–500			
		100	—	1·55	33·97	27·21	1·77	—	—	12·8	7·15	,,	1000–750			
		150	—	0·44	34·07	27·36	2·13	—	—	31·9	6·62	**NHP**	50–0	—	1455	
		200	—	0·73	34·15	27·41	2·43	—	—	40·6	6·05	**CWS**	0			
		300	—	1·79	34·39	27·53	2·68	—	—	47·1	4·42	,,	5			
		400	—	1·88	34·51	27·61	2·85	—	—	58·8	4·04	,,	10			
		600^1	—	1·92	34·63	27·71	2·53	—	—	63·0	3·92	,,	20			
		800^2	798	1·86	34·69	27·75	2·53	—	—	67·7	4·10	,,	50			
		1000^2	—	1·69	34·70	27·78	2·53	—	—	76·3	3·95	,,	100			
		1500^2	—	1·26	34·72	27·82	2·59	—	—	85·8	4·22					
		1990^1	—	0·91	34·70	27·84	2·59	—	—	92·4	4·42					
		2490^1	2492	0·55	34·69	27·84	2·53	—	—	97·1	4·62					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1506	54° 22·4′ S, 35° 12·7′ W	1935 7 ii	1726	858*	NNE	18	NNE	4	omd	999·0	2·6	2·2	mod. NNE swell
1507	54° 22·6′ S, 35° 47·5′ W	7 ii	2127	265*	NE	8	NE	3	omd	993·7	2·8	2·5	mod. NE swell
1508	54° 22·6′ S, 34° 08·6′ W	8 ii	0714	4565*	N	10	N	3	ome	988·7	2·8	2·5	mod. conf. NE swell
1509	56° 22·1′ S, 31° 37·8′ W	9 ii	0900	3290*	NW	9	NW	3	bc	982·2	3·2	1·8	mod. NW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1506	4	0	—	2·40	33·96	27·13	1·43	—	—	13·2	7·31	**N 70 V**	50–0	1733		
		5	—	2·40	—	—	—	—	—	—	—	,,	100–50			
		10	—	2·39	33·96	27·13	1·46	—	—	13·3	—	,,	250–100			
		20	—	2·38	33·96	27·13	1·44	—	—	13·3	7·31	,,	500–250			
		30	—	2·34	33·96	27·14	1·44	—	—	13·5	—	,,	750–500			
		40	—	2·17	33·96	27·15	1·50	—	—	14·1	7·22	**NHP**	50–0	—	1855	
		50	—	2·01	33·96	27·16	1·56	—	—	14·9	—	**CWS**	0			
		60	—	1·95	33·96	27·17	1·63	—	—	14·9	7·08	,,	5			
		80	—	1·83	33·98	27·19	1·63	—	—	14·8	—	,,	10			
		100	—	1·52	33·98	27·22	1·73	—	—	17·6	7·05	,,	20			
		150	—	0·69	34·15	27·41	2·17	—	—	36·4	6·10	,,	50			
		200	—	1·23	34·27	27·47	2·47	—	—	45·5	5·19	,,	100			
		300	—	1·66	34·42	27·55	2·70	—	—	51·1	4·51	**N 70 B**	113–0	1903	1923	KT
		395^1	388	1·94	34·50	27·59	2·70	—	—	52·8	4·08	**N 100 B**				
		590^1	—	2·00	34·60	27·67	2·70	—	—	60·0	3·87					
		790^1	798	1·89	34·64	27·72	2·70	—	—	66·2	3·96					
1507	4	0	—	2·44	33·74	26·95	1·37	—	—	9·8	7·28	**N 70 V**	50–0	**2136**		
		5	—	2·44	—	—	—	—	—	—	—	,,	100–50			
		10	—	2·44	33·74	26·95	1·39	—	—	9·9	—	,,	225–100			
		20	—	2·43	33·77	26·97	1·39	—	—	10·1	7·28	**NHP**	50–0	—	**2211**	
		30	—	2·33	33·81	27·02	1·41	—	—	10·0	—	**CWS**	0			
		40	—	2·28	33·84	27·04	1·44	—	—	11·2	7·27	,,	5			
		50	—	2·24	33·84	27·04	1·43	—	—	11·7	—	,,	10			
		60	—	1·73	33·92	27·15	1·71	—	—	17·6	7·04	,,	20			
		80	—	1·12	34·03	27·28	2·09	—	—	24·9	—	,,	50			
		100	—	0·92	34·06	27·32	2·24	—	—	31·1	6·66	,,	100			
		150	—	0·82	34·14	27·39	2·34	—	—	36·4	6·26	**N 70 B**	119–0	**2226**	**2246**	KT
		200	—	1·02	34·24	27·46	2·62	—	—	40·8	5·61	**N 100 B**				
1508	5	0	—	2·19	34·01	27·19	1·60	—	—	11·1	7·15	**N 70 B**	155–0	0718	0738	KT
		5	—	2·17	—	—	—	—	—	—	—	**N 100 B**				
		10	—	2·17	34·01	27·19	1·58	—	—	11·1	—	**N 70 V**	50–0	0752		
		20	—	2·16	34·01	27·19	1·60	—	—	11·1	7·15	,,	100–50			
		30	—	2·15	34·01	27·19	1·62	—	—	11·5	—	,,	250–100			
		40	—	2·13	34·01	27·19	1·60	—	—	11·2	7·14	,,	500–250			
		50	—	2·08	34·01	27·20	1·67	—	—	11·1	—	,,	750–500			
		60	—	2·03	34·01	27·20	1·65	—	—	11·9	7·12	,,	1000–750			
		80	—	1·89	34·01	27·21	1·69	—	—	12·0	—	**NHP**	50–0	—	0959	
		95	—	1·20	34·07	27·31	1·79	—	—	22·8	7·02	**CWS**	0			
		140	—	0·26	34·22	27·48	2·43	—	—	42·3	6·25	,,	5			
		190	—	0·23	34·25	27·51	2·43	—	—	53·8	6·10	,,	10			
		280	—	0·84	34·45	27·63	2·76	—	—	59·7	4·81	,,	20			
		375	—	1·32	34·58	27·71	2·76	—	—	66·5	4·32	,,	50			
		560^1	554	1·72	34·64	27·73	2·76	—	—	70·6	4·01	,,	100			
		750^1	—	1·58	34·68	27·77	2·74	—	—	79·1	4·04					
		940^1	—	1·40	34·69	27·78	2·60	—	—	83·6	4·16					
		1410^1	1421	0·88	34·70	27·84	2·60	—	—	85·7	4·47					
		1860^2	1865	0·57	34·69	27·84	2·64	—	—	91·1	4·56					
		2320^2	—	0·36	34·68	27·85	2·70	—	—	98·4	4·65					
		2790^2	—	0·21	34·67	27·85	2·70	—	—	103·3	4·75					
		3250^2	—	0·07	34·67	27·86	2·70	—	—	110·3	4·77					
		3720^2	3711	−0·05	34·67	27·86	2·68	—	—	116·9	4·97					
1509	6	0	—	2·09	34·00	27·19	1·43	—	0·23	10·2	7·24	**N 50 V**	100–0	0909		
		5	—	2·08	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	2·05	34·00	27·19	1·43	—	0·23	9·8	—	,,	100–50			
		20	—	2·04	34·01	27·20	1·44	—	0·24	9·7	7·24	,,	250–100			
		30	—	2·03	34·01	27·20	1·44	—	0·24	12·0	—	,,	500–250			
		40	—	1·94	34·01	27·21	1·50	—	0·24	12·6	7·21	,,	750–500			
		50	—	1·93	34·01	27·21	1·48	—	0·22	12·7	—	,,	1000–750			
		60	—	1·92	34·01	27·21	1·46	—	0·23	12·6	7·16	**NHP**	50–0	—	1030	
		80	—	0·92	34·06	27·32	1·84	—	0·21	22·7	—	**CWS**	0			
		100	—	0·33	34·16	27·43	2·32	—	0·25	33·2	6·46	,,	5			
		150	—	1·20	34·34	27·53	2·64	—	0·06	44·2	4·89	,,	10			
		200	—	1·64	34·44	27·58	2·68	—	0·00	47·8	4·28	,,	20			
		300	—	1·66	34·52	27·64	2·68	—	0·00	53·1	4·10	,,	50			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1509 *cont.*	56° 22·1′ S, 31° 37·8′ W	1935 9 ii											
1510	59° 36·9′ S, 26° 57·7′ W	10 ii	2100	1670*	S	2–3	S	2	o	992·4	−0·6	−1·9	mod. conf. S swell
1511	61° 34·3′ S, 22° 46·3′ W	11 ii	2000	4779*	NW×N	6	NW×N	2	bc	994·5	−0·4	−1·2	low conf. swell
1512	62° 35·4′ S, 20° 38·6′ W	12 ii	0906	5009*	NW	6	NW	2	c	991·2	1·4	−0·3	low conf. swell
1513	63° 54·2′ S, 18° 21·2′ W	12 ii	2000	4978*	WSW	16	WSW	3	osp	991·7	−1·7	−2·6	low W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.^{3}							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1509 *cont.*	6	400	—	1·63	34·59	27·70	2·72	—	0·00	57·6	4·08	**CWS**	100			
		600[1]	600	1·82	34·69	27·75	2·57	—	—	59·4	4·05	**N 70 B**	128–0	1110	1130	KT
		800[1]	—	1·53	34·70	27·79	2·57	—	—	67·0	4·14	**N 100 B**				
		1000[2]	996	1·37	34·70	27·81	2·45	—	—	72·2	4·32					
		1500[2]	—	0·86	34·71	27·85	2·47	—	—	80·4	4·43					
		2000[2]	—	0·51	34·71	27·87	2·64	—	—	90·6	4·58					
		2500[2]	—	0·27	34·70	27·88	2·64	—	—	88·4	4·70					
		3000[2]	3006	0·07	34·69	27·87	2·64	—	—	80·5	4·85					
1510	7	0	—	−0·30	33·70	27·09	1·63	—	0·24	54·6	7·77	**N 50 V**	100–0	**2113**		+3 hours
		5	—	−0·30	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·31	33·71	27·10	1·71	—	0·24	54·3	—	,,	100–50			
		20	—	−0·31	33·72	27·11	1·75	—	0·24	54·6	7·78	,,	250–100			
		30	—	−0·33	33·72	27·12	1·75	—	0·23	57·8	—	,,	500–250			
		40	—	−0·39	33·72	27·12	1·75	—	0·23	59·2	7·76	,,	750–500			
		50	—	−0·78	33·72	27·13	1·75	—	0·20	60·7	—	,,	1000–750			
		60	—	−1·40	34·07	27·44	2·09	—	0·14	61·1	7·18	**NHP**	50–0	—	**2237**	
		80	—	−1·42	34·32	27·64	2·47	—	0·14	63·7	—	**CWS**	0			
		100	—	−1·01	34·43	27·72	2·49	—	0·16	71·8	5·67	,,	5			
		145	—	−0·44	34·58	27·81	2·59	—	0·06	77·3	5·05	,,	10			
		195	—	−0·15	34·61	27·83	2·60	—	0·00	86·1	4·70	,,	20			
		290	—	0·12	34·69	27·86	2·64	—	0·00	91·1	4·54	,,	50			
		385	—	0·15	34·69	27·86	2·70	—	0·00	93·0	4·50	,,	100			
		580[1]	576	0·30	34·69	27·85	2·66	—	—	99·5	4·49	**N 70 B**	155–0	**2250**	**2310**	KT
		770[1]	—	0·25	34·69	27·86	2·66	—	—	101·1	4·41	**N 100 B**				
		960[1]	—	0·16	34·68	27·86	2·66	—	—	100·5	4·55					
		1450[1]	1447	−0·06	34·66	27·85	2·72	—	—	95·1	4·70					
1511	8	0	—	−0·05	33·79	27·16	1·79	—	0·24	57·7	7·59	**N 50 V**	100–0	**2013**		
		5	—	−0·05	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·04	33·79	27·16	1·79	—	0·25	58·3	—	,,	100–50			
		20	—	−0·04	33·79	27·16	1·77	—	0·26	58·3	7·59	,,	250–100			
		30	—	−0·07	33·79	27·16	1·81	—	0·24	58·8	—	,,	500–250			
		40	—	−0·08	33·80	27·16	1·77	—	0·24	59·5	7·60	,,	750–500			
		50	—	−1·19	34·16	27·50	1·79	—	0·13	58·5	—	,,	1000–750			
		60	—	−1·69	34·38	27·70	1·84	—	0·05	60·2	7·09	**NHP**	50–0	—	**2132**	
		80	—	−1·73	34·43	27·74	2·07	—	0·05	59·7	—	**CWS**	0			
		100	—	−1·69	34·45	27·75	2·28	—	0·05	63·4	6·38	,,	5			
		150	—	−0·88	34·57	27·82	2·34	—	0·05	68·0	5·44	,,	10			
		195	—	0·03	34·66	27·85	2·57	—	0·00	73·2	4·48	,,	20			
		290	—	0·24	34·69	27·86	2·62	—	0·00	81·5	4·28	,,	50			
		390	—	0·25	34·69	27·86	2·64	—	0·00	88·1	4·24	,,	100			
		580[1]	573	0·38	34·70	27·87	2·64	—	—	96·4	4·19	**N 70 B**	93–0	**2321**	**2341**	KT
		780[1]	—	0·31	34·70	27·87	2·66	—	—	99·6	4·31	**N 100 B**				
		970[1]	—	0·25	34·70	27·88	2·64	—	—	106·8	4·41	**N 70 B**	390–190	**2321**	**2351**	DGP
		1460[1]	—	−0·04	34·69	27·87	2·64	—	—	102·3	4·69	**N 100 B**				
		1950[1]	1960	−0·16	34·69	27·88	2·64	—	—	96·3	5·03					
		2460[2]	2416	−0·29	34·69	27·89	2·64	—	—	97·3	5·26					
		2950[2]	—	−0·38	34·69	27·89	2·64	—	—	92·5	5·18					
		3440[2]	—	−0·42	34·68	27·89	2·64	—	—	90·0	5·32					
		3940[2]	—	−0·50	34·67	27·89	2·64	—	—	81·9	5·34					
		4430[2]	4470	−0·51	34·67	27·89	2·64	—	—	78·4	5·44					
1512	9	0	—	0·30	34·00	27·30	—	—	—	—	—	**N 70 B**	135–0	0927	0947	KT
												N 100 B				
												CWS	0			
1513	9	0	—	−0·09	33·97	27·31	1·79	—	0·27	51·0	7·61	**N 50 V**	100–0	**2009**		
		5	—	−0·09	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·08	33·97	27·30	1·58	—	0·27	51·6	—	,,	100–50			
		20	—	−0·08	33·97	27·30	1·71	—	0·27	53·6	7·63	,,	250–100			
		30	—	−0·09	33·97	27·31	1·67	—	0·28	55·0	—	,,	500–250			
		40	—	−0·76	34·09	27·43	1·75	—	0·24	56·2	7·42	,,	750–500	—	—	Net may not have fished properly
		50	—	−1·63	34·33	27·64	2·07	—	0·15	56·4	—	,,	750–330			
		60	—	−1·73	34·37	27·69	2·17	—	0·13	58·3	6·80	,,	1000–750			
		80	—	−1·79	34·42	27·72	2·19	—	0·14	61·2	—	,,	1000–0			
		100	—	−1·69	34·43	27·74	2·38	—	0·13	62·2	6·30	**NHP**	50–0	—	**2225**	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1513 *cont.*	63° 54·2′ S, 18° 21·2′ W	1935 12 ii											
1514	65° 03·6′ S, 16° 17·2′ W	13 ii	0900	5020*	NW	11	NW	3	c	991·7	−1·7	−1·8	mod. W swell
1515	66° 14·7′ S, 13° 50·2′ W	13 ii	2000	4923*	NNW	6	NNW	2	c	988·1	−2·0	−2·1	low NW swell
1516	67° 22′ S, 11° 31·4′ W	14 ii	0900	4908*	N × W	9	N × W	3	csp	985·0	−0·7	−1·0	low NW swell
1517	68° 44·7′ S, 09° 20·3′ W	14 ii	2020	3974*	NW × W	12	NW × W	2	bc	983·1	−2·7	−2·9	mod. NW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1513 *cont.*	9	150	—	−1·04	34·52	27·79	2·47	—	0·00	72·2	5·62	**CWS**	0			
		200	—	0·03	34·65	27·84	2·59	—	0·00	81·9	4·65	,,	5			
		300	—	0·32	34·69	27·85	2·59	—	0·00	86·7	4·28	,,	10			
		395	—	0·24	34·69	27·86	2·64	—	0·00	80·2	4·26	,,	20			
		590^1	587	0·38	34·69	27·85	2·72	—	—	98·3	4·16	,,	50			
		790^1	—	0·32	34·69	27·85	2·74	—	—	107·0	4·28	,,	100			
		990^1	—	0·22	34·69	27·86	2·74	—	—	107·8	4·39	**N 70 B**	90–0	**2324**	**2344**	KT
		1480^1	—	0·01	34·69	27·87	2·64	—	—	110·3	4·76	**N 100 B**				
		1980^1	1980	−0·18	34·69	27·88	2·64	—	—	103·9	4·86	**N 70 B**	350–220	**2324**	**2354**	DGP
		2500^2	2497	−0·28	34·69	27·89	2·64	—	—	100·9	5·01	**N 100 B**				
		3000^2	—	−0·34	34·68	27·89	2·60	—	—	101·5	5·28					
		3500^2	—	−0·38	34·67	27·88	2·57	—	—	98·6	5·35					
		4000^2	—	−0·47	34·67	27·88	2·60	—	—	97·4	5·31					
		4500^2	4494	−0·50	34·67	27·89	2·49	—	—	86·7	5·53					
1514	10	0	—	0·40	34·01	27·31	—	—	—	—	—	**NHP**	50–0	0915	0920	
												N 70 B **N 100 B**	133–0	0927	0947	KT
1515	10	0	—	−0·56	33·39	26·85	1·50	—	0·33	40·4	7·82	**N 50 V**	100–0	**2012**		
		5	—	−0·55	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−0·55	33·39	26·85	1·48	—	0·34	40·6	—	,,	100–50			
		20	—	−0·58	33·43	26·90	1·46	—	0·31	42·8	7·81	,,	250–100			
		30	—	−1·38	34·25	27·58	1·65	—	0·17	45·7	—	,,	500–250			
		40	—	−1·68	34·33	27·64	1·67	—	0·16	50·7	7·00	,,	750–500			
		50	—	−1·78	34·40	27·71	2·03	—	0·16	53·8	—	,,	1000–750			
		60	—	−1·82	34·40	27·71	2·05	—	0·17	53·6	6·53	**NHP**	50–0	—	**2134**	
		80	—	−1·71	34·43	27·74	2·05	—	0·29	54·6	—	**CWS**	0			
		95	—	−0·99	34·47	27·74	2·07	—	0·06	61·3	5·77	,,	5			
		140	—	0·43	34·63	27·81	2·45	—	0·00	80·1	4·39	,,	10			
		185	—	0·73	34·67	27·82	2·45	—	0·00	84·3	4·27	,,	20			
		280	—	0·64	34·69	27·83	2·47	—	0·00	76·1	4·33	,,	50			
		370	—	0·50	34·69	27·84	2·47	—	0·00	87·8	4·34	,,	100			
		550^1	541	0·52	34·70	27·86	2·51	—	—	92·2	4·22	**N 70 B**	88–0	**2320**	**2340**	KT
		740^1	—	0·44	34·70	27·87	2·55	—	—	97·4	4·22	**N 100 B**				
		930^1	—	0·36	34·70	27·87	2·51	—	—	102·6	4·31	**N 70 B**	330–180	**2320**	**2350**	DGP
		1390^1	—	0·15	34·69	27·86	2·51	—	—	103·6	4·56	**N 100 B**				
		1850^1	1866	−0·04	34·69	27·87	2·51	—	—	99·3	4·82					
		2450^2	2456	−0·20	34·69	27·88	2·45	—	—	99·8	5·01					
		2940^2	—	−0·28	34·68	27·89	2·45	—	—	104·5	5·03					
		3430^2	—	−0·30	34·67	27·88	2·45	—	—	95·2	5·14					
		3920^2	—	−0·37	34·67	27·88	2·47	—	—	94·1	5·21					
		4410^2	4406	−0·43	34·67	27·88	2·47	—	—	96·3	5·31					
1516	11	0	—	−0·70	33·50	26·95	—	—	—	—	—	**N 50 V**	100–0	0906		
												NHP	50–0	—	0918	
												N 70 B **N 100 B**	124–0	0924	0944	KT
1517	11	0	—	−1·44	33·40	26·89	1·60	—	0·30	53·4	7·77	**N 50 V**	100–0	**2027**	—	+2 hours
		5	—	−1·44	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·44	33·40	26·89	1·62	—	0·29	53·6	—	,,	100–50			
		20	—	−1·44	33·42	26·91	1·67	—	0·27	55·5	7·77	,,	250–100			
		30	—	−1·49	34·13	27·48	1·82	—	0·17	57·6	—	,,	500–250			
		40	—	−1·59	34·32	27·64	2·01	—	0·16	58·4	6·58	,,	750–500			
		50	—	−1·74	34·34	27·67	2·13	—	0·17	62·2	—	,,	1000–750			
		60	—	−1·79	34·39	27·71	2·13	—	0·18	62·8	6·25	**NHP**	50–0	—	**2147**	
		80	—	−1·85	34·42	27·72	2·15	—	0·21	62·7	—	**CWS**	0			
		100	—	−1·84	34·43	27·74	2·22	—	0·14	67·6	5·99	,,	5			
		150	—	−0·54	34·54	27·79	2·38	—	0·00	70·7	5·16	,,	10			
		200	—	0·50	34·67	27·83	2·45	—	0·00	80·8	4·43	,,	20			
		295	—	0·76	34·70	27·85	2·57	—	0·00	86·7	4·32	,,	50			
		395	—	0·73	34·70	27·85	2·57	—	0·00	80·8	4·36	,,	100			
		590^1	581	0·72	34·70	27·85	2·57	—	—	88·2	4·31	**N 70 B**	108–0	**2246**	**2306**	KT
		790^1	—	0·61	34·70	27·86	2·57	—	—	96·5	4·39	**N 100 B**				
		980^1	989	0·44	34·70	27·87	2·64	—	—	101·1	4·44	**N 70 B**	420–230	**2246**	**2316**	DGP
		1480^2	1472	0·23	34·69	27·86	2·64	—	—	102·3	4·52	**N 100 B**				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1517 *cont.*	68° 44·7′ S, 09° 20·3′ W	1935 14 ii											
1518	67° 40·9′ S, 06° 31·8′ W	15 ii	0900	4702*	NW × W	10	NW × W	3	bc	984·6	−1·7	−2·2	mod. NW swell
1519	66° 31′ S, 03° 40′ W	15 ii	2000	4369*	Lt airs	1–2	—	1	b	990·6	−1·5	−1·6	mod. W swell
1520	65° 28·8′ S, 01° 20·3′ W	16 ii	0900	4665*	SSW	5	SSW	2	b	993·6	0·1	0·1	low WSW swell
1521	64° 34·5′ S, 00° 45·8′ E	16 ii	2000	3297*	S	10	S	2	bc	994·3	−1·1	−1·7	mod. W swell
1522	65° 32·9′ S, 03° 02·9′ E	17 ii	0900	2575*	S	14	S	3	o	994·9	−0·6	−0·7	mod. S swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS					Mg.—atom m.^{3}					BIOLOGICAL OBSERVATIONS		TIME		Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1517 *cont.*	11	1970^2	—	0·01	34·69	27·87	2·64	—	—	101·2	4·78	**N 100 H**	0–5	**2246**	**2317**	
		2460^2	—	−0·13	34·68	27·88	2·64	—	—	102·8	4·95					
		2960^2	—	−0·21	34·68	27·88	2·43	—	—	104·6	5·09					
		3450^2	3457	−0·26	34·67	27·87	2·47	—	—	103·4	5·20					
1518	12	0	—	−1·10	33·25	26·76	—	—	—	—	—	**N 50 V**	100–0	0905		
												NHP	50–0	—	0918	
												N 70 B }	133–0	0926	0946	KT
												N 100 B }				
1519	12	0	—	0·10	33·63	27·02	1·56	—	0·30	49·7	7·68	**N 70 V**	50–0	**2011**		
		5	—	0·10	—	—	—	—	—	—	—	,,	100–50			
		10	—	0·10	33·64	27·02	1·56	—	0·29	52·9	—	,,	250–100			
		20	—	0·08	33·64	27·03	1·56	—	0·29	54·3	7·66	,,	500–250			
		30	—	−0·10	33·81	27·18	1·56	—	0·29	55·3	—	,,	750–500			
		40	—	−1·33	33·82	27·23	2·09	—	0·18	59·9	6·84	,,	1000–750	—	**2136**	
		50	—	−1·37	34·35	27·67	2·20	—	0·19	60·0	—	**NHP**	50–0	**2250**	**2256**	
		60	—	−1·52	34·41	27·71	2·20	—	0·28	59·5	6·30	**CWS**	0			
		75	—	−1·36	34·44	27·74	2·30	—	0·26	60·9	—	,,	5			
		90	—	−0·63	34·51	27·76	2·30	—	0·00	62·5	5·41	,,	10			
		140	—	0·76	34·67	27·82	2·38	—	0·00	68·4	4·27	,,	20			
		185	—	0·89	34·69	27·82	2·43	—	0·00	74·4	4·26	,,	30			
		275	—	0·93	34·70	27·84	2·26	—	0·00	81·2	4·26	,,	50			
		370	—	0·90	34·71	27·85	2·43	—	0·00	88·4	4·30	**N 70 B** }	82–0	**2315**	**2335**	KT
		550^1	539	0·72	34·70	27·85	2·47	—	—	91·5	4·24	**N 100 B** }				
		740^1	—	0·59	34·70	27·86	2·43	—	—	96·9	4·36	**N 70 B** }	310–150	**2315**	**2345**	DGP
		920^1	—	0·50	34·70	27·86	2·57	—	—	97·9	4·29	**N 100 B** }				
		1380^1	1395	0·25	34·68	27·86	2·68	—	—	98·6	4·49	**N 100 H**	0–5	**2315**	**2345**	
		1980^2	1984	0·03	34·68	27·87	2·68	—	—	99·1	4·69					
		2470^2	—	−0·09	34·67	27·87	2·60	—	—	100·2	4·98					
		2970^2	—	−0·21	34·67	27·87	2·60	—	—	91·1	5·11					
		3460^2	—	−0·28	34·67	27·88	2·60	—	—	92·6	5·29					
		3960^2	3950	−0·31	34·66	27·87	2·62	—	—	93·4	5·25					
1520	13	0	—	0·30	33·68	27·04	—	—	—	—	—	**N 50 V**	100–0	0903	–	+1 hour 45 minutes
												NHP	50–0	—	0915	
												N 70 B }	153–0	0921	0941	KT
												N 100 B }				
1521	13	0	—	0·21	33·92	27·25	1·58	—	0·29	52·2	7·68	**N 50 V**	100–0	**2012**	—	+1 hour
		5	—	0·21	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·20	33·92	27·25	1·58	—	0·28	53·4	—	,,	100–50			
		20	—	0·20	33·92	27·25	1·58	—	0·28	52·7	7·68	,,	250–100			
		30	—	−0·02	33·98	27·31	1·67	—	0·26	53·7	—	,,	500–250			
		40	—	−0·60	34·18	27·50	1·94	—	0·22	54·4	7·05	,,	750–500			
		50	—	−1·13	34·41	27·70	2·26	—	0·19	57·4	—	,,	1000–750			
		60	—	−0·60	34·49	27·74	2·38	—	0·17	57·9	5·67	**NHP**	50–0	—	**2224**	
		80	—	−0·10	34·55	27·78	2·38	—	0·16	64·8	—	**CWS**	0			
		100	—	0·58	34·61	27·79	2·55	—	0·11	74·1	4·43	,,	5			
		150	—	0·98	34·67	27·80	2·38	—	0·00	76·6	4·19	,,	10			
		200	—	1·11	34·69	27·80	2·40	—	0·00	78·2	4·14	,,	20			
		300	—	1·21	34·70	27·82	2·49	—	0·00	80·8	4·16	,,	30			
		400	—	1·14	34·71	27·83	2·68	—	0·00	85·7	4·26	,,	50			
		600^1	597	0·84	34·70	27·84	2·55	—	—	91·3	4·33	**N 70 B** }	137–0	**2240**	**2300**	KT
		800^1	—	0·63	34·70	27·85	2·53	—	—	93·6	4·36	**N 100 B** }				
		1000^2	995	0·49	34·69	27·84	2·68	—	—	98·4	4·30	**N 70 B** }	500–220	**2240**	**2310**	Depths estimated
		1490^2	—	0·24	34·68	27·86	2·68	—	—	103·9	4·47	**N 100 B** }				
		1990^2	—	0·03	34·67	27·86	2·68	—	—	111·0	4·69	**N 100 H**	0–5	**2240**	**2310**	
		2490^2	—	−0·08	34·67	27·86	2·68	—	—	116·6	4·93					
		2990^2	2986	−0·21	34·67	27·87	2·68	—	—	110·3	5·00					
1522	14	0	—	0·08	34·10	27·40	—	—	—	—	—	**N 50 V**	100–0	0908		
												NHP	50–0	—	0921	
												N 70 B }	170–0	0926	0946	KT
												N 100 B }				

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1523	66° 39·2′ S, 05° 28·2′ E	1935 17 ii	2000	3987*	SSE	12	SSE	2	bc	994·9	−0·9	−1·1	mod. SE swell
1524	67° 41·3′ S, 08° 00·6′ E	18 ii	0900	4049*	SE × S	14	SE	3	c	990·7	−0·5	−0·6	mod. SE × S swell
1525	68° 41·8′ S, 10° 34·8′ E	18 ii	2000	2218*	SE	1–2	—	0–1	o	990·7	−5·2	−5·2	low E swell
1526	68° 02·6′ S, 12° 32·2′ E	19 ii	0900	2599*	ESE	4	ESE	0–1	o	989·6	−6·4	−6·4	low NE swell
1527	66° 57·2′ S, 15° 10·3′ E	19 ii	2000	3981*	SE	1–2	0–1	—	o	987·9	0·0	−0·2	low conf. E swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³ P	Mg.—atom m.³ Nitrate + Nitrite N₂	Mg.—atom m.³ Nitrite N₂	Mg.—atom m.³ Si	O₂ c.c. litre	Gear	Depth (metres)	TIME From	TIME To	
1523	14	0	—	0·53	33·72	27·07	1·58	—	0·27	52·3	7·76	**N 50 V**	100–0	**2012**		
		5	—	0·53	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·53	33·72	27·07	1·58	—	0·27	53·4	—	,,	100–50			
		20	—	0·51	33·72	27·07	1·56	—	0·26	53·4	7·75	,,	250–100			
		30	—	0·30	33·78	27·13	1·62	—	0·24	56·7	—	,,	500–250			
		40	—	−1·00	34·38	27·67	2·13	—	0·13	57·9	6·27	,,	750–500			
		50	—	−0·91	34·44	27·72	2·36	—	0·13	63·0	—	,,	1000–750			
		60	—	−0·90	34·48	27·75	2·36	—	0·19	64·5	5·76	**NHP**	50–0	—	**2131**	
		80	—	−0·14	34·55	27·78	2·45	—	0·16	64·9	—	**CWS**	0			
		100	—	0·53	34·62	27·80	2·53	—	0·15	71·8	4·47	,,	5			
		150	—	0·91	34·68	27·82	2·57	—	0·00	76·8	4·19	,,	10			
		200	—	1·02	34·70	27·83	2·53	—	0·00	77·8	4·19	,,	20			
		300	—	1·11	34·70	27·82	2·53	—	0·00	79·2	4·22	,,	30			
		400	—	1·12	34·70	27·82	2·53	—	0·00	86·1	4·28	,,	50			
		600^1	609	0·75	34·69	27·83	2·55	—	—	89·5	4·33	**N 70 B**	109–0	**2241**	**2301**	KT
		800^1	—	0·59	34·69	27·84	2·60	—	—	91·1	4·36	**N 100 B**				
		990^1	982	0·50	34·68	27·84	2·60	—	—	91·4	4·44	**N 70 B**	450–270	**2241**	**2311**	DGP
		1490^2	1484	0·25	34·68	27·86	2·60	—	—	95·5	4·73	**N 100 B**				
		1990^2	—	0·03	34·68	27·87	2·60	—	—	94·1	4·79	**N 100 H**	0–5	**2241**	**2311**	
		2490^2	—	−0·09	34·67	27·87	2·68	—	—	93·6	4·95					
		2990^2	—	−0·20	34·67	27·87	2·68	—	—	94·3	5·10					
		3480^2	3493	−0·28	34·67	27·88	2·68	—	—	95·5	5·15					
1524	15	0	—	0·50	33·95	27·25	—	—	—	—	—	**N 50 V**	100–0	0908	—	+0 hour 45 minutes
												NHP	50–0	—	0919	
												N 70 B	146–0	0931	0951	KT
												N 100 B				
1525	15	0	—	0·15	34·04	27·34	1·77	—	0·24	52·7	7·58	**N 50 V**	100–0	**2010**	—	GMT
		5	—	0·16	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·15	34·04	27·34	1·77	—	0·25	53·2	—	,,	100–50			
		20	—	0·11	34·04	27·34	1·79	—	0·24	53·6	7·62	,,	250–100			
		30	—	−0·46	34·13	27·44	1·77	—	0·15	54·6	—	,,	500–250			
		40	—	−1·10	34·29	27·60	1·77	—	0·08	53·6	7·25	,,	750–500			
		50	—	−1·36	34·37	27·68	1·96	—	0·06	55·7	—	,,	1000–750			
		60	—	−1·45	34·37	27·68	2·01	—	0·06	56·9	7·05	**NHP**	50–0	—	**2213**	
		80	—	−1·65	34·41	27·71	2·26	—	0·06	57·6	—	**CWS**	0			
		100	—	−1·58	34·42	27·71	2·26	—	0·07	58·6	6·55	,,	5			
		150	—	−1·57	34·44	27·74	2·36	—	<0·04	58·1	6·25	,,	10			
		200	—	−0·59	34·51	27·76	2·38	—	0·00	65·6	5·56	,,	20			
		300	—	0·42	34·61	27·80	2·49	—	0·00	81·2	4·77	,,	30			
		400	—	1·03	34·68	27·81	2·49	—	0·00	87·5	4·43	,,	50			
		600^1	596	0·83	34·69	27·82	2·51	—	—	92·6	4·30	**N 70 B**	108–0	**2230**	**2250**	KT
		800^1	—	0·69	34·69	27·83	2·51	—	—	99·3	4·39	**N 100 B**				
		1000^1	—	0·50	34·68	27·84	2·51	—	—	100·2	4·45	**N 70 B**	430–230	**2230**	**2300**	DGP
		1500^1	1497	0·22	34·68	27·86	2·51	—	—	101·6	4·51	**N 100 B**				
		2000^1	—	0·02	34·67	27·86	2·51	—	—	104·2	4·75	**N 100 H**	0–5	**2230**	**2300**	
1526	16	0	—	0·00	33·95	27·28	—	—	—	—	—	**N 50 V**	100–0	0907		
												NHP	50–0	—	0918	
												N 70 B	143–0	0927	0947	KT
												N 100 B				
1527	16	0	—	0·45	34·16	27·43	1·88	—	0·24	50·0	7·49	**N 50 V**	100–0	**2008**		
		5	—	0·45	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·45	34·16	27·43	1·90	—	0·24	49·9	—	,,	100–50			
		20	—	0·43	34·16	27·43	1·90	—	0·25	49·7	7·52	,,	250–100			
		30	—	0·12	34·17	27·45	1·96	—	0·22	51·3	—	,,	500–250			
		40	—	−1·26	34·32	27·63	2·09	—	0·09	53·8	7·33	,,	750–500			
		50	—	−1·56	34·38	27·69	2·24	—	0·08	53·6	—	,,	1000–750			
		60	—	−1·64	34·39	27·70	2·32	—	0·07	53·7	6·93	**NHP**	50–0	—	**2201**	
		80	—	−1·68	34·41	27·72	2·32	—	0·11	54·3	—	**CWS**	0			
		100	—	−1·68	34·42	27·72	2·32	—	0·11	55·0	6·65	,,	5			
		150	—	−1·66	34·44	27·74	2·40	—	<0·04	55·1	6·43	,,	10			
		200	—	−1·25	34·49	27·76	2·40	—	0·00	62·2	6·09	,,	20			
		300	—	0·55	34·63	27·80	2·51	—	0·00	69·2	4·62	,,	30			
		400	—	1·02	34·69	27·81	2·51	—	0·00	80·1	4·37	,,	50			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1527 *cont.*	66° 57·2′ S, 15° 10·3′ E	1935 19 ii											
1528	66° 01·7′ S, 17° 20·5′ E	20 ii	0900	—	E	2	—	0–1	os	991·2	1·1	0·9	low E swell
1529	64° 54·7′ S, 20° 00·6′ E	20 ii	2000	4775*	N×W	11	N×W	2	bc	994·1	−0·3	−0·7	low conf. NE swell
1530	63° 55·5′ S, 22° 06·6′ E	21 ii	0900	4850*	SSE	7	SSE	2	c	996·0	1·1	0·1	mod. W swell
1531	62° 50′ S, 24° 28·2′ E	21 ii	2000	4938*	Lt airs	2	—	1	bc	995·7	0·8	0·3	low conf. swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1527 *cont.*	16	600^1	596	0·83	34·70	27·84	2·51	—	—	83·9	4·44	**N 70 B**	100–0	**2234**	**2254**	KT
		790^1	—	0·64	34·70	27·85	2·62	—	—	88·9	4·45	**N 100 B**				
		990^1	990	0·49	34·70	27·86	2·64	—	—	91·8	4·49	**N 70 B**	420–350	**2234**	**2304**	DGP
		1470^2	1478	0·25	34·68	27·86	2·64	—	—	102·8	4·56	**N 100 B**				
		1960^2	—	0·04	34·68	27·87	2·62	—	—	108·9	4·88	**N 100 H**	0–5	**2234**	**2304**	
		2450^2	—	−0·09	34·67	27·87	2·64	—	—	109·6	4·94					
		2940^2	—	−0·19	34·67	27·87	2·64	—	—	102·1	4·98					
		3430^2	3422	−0·25	34·67	27·87	2·64	—	—	101·3	5·17					
1528	17	0	—	1·02	34·13	27·36	—	—	—	—	—	**N 50 V**	100–0	0903		
												NHP	50–0	—	0914	
												N 70 B	108–0	0922	0942	KT
												N 100 B				
1529	17	0	—	0·95	33·97	27·25	1·29	—	0·29	12·6	7·65	**N 50 V**	100–0	**2015**		
		5	—	0·96	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·96	33·97	27·25	1·22	—	0·29	12·8	—	,,	100–50			
		20	—	0·96	33·97	27·25	1·22	—	0·28	13·9	7·68	,,	250–100			
		30	—	0·92	33·97	27·25	1·24	—	0·29	14·9	—	,,	500–250			
		40	—	−1·16	34·24	27·57	2·13	—	0·22	35·7	7·20	,,	750–500			
		50	—	−1·56	34·35	27·67	2·28	—	0·21	37·1	—	,,	1000–750			
		60	—	−1·69	34·36	27·68	2·36	—	0·23	42·0	6·74	,,	1000–0			
		80	—	−1·58	34·40	27·70	2·36	—	0·27	46·5	—	**NHP**	50–0	—	**2219**	
		100	—	−1·34	34·41	27·71	2·36	—	0·27	49·8	6·38	**CWS**	0			
		150	—	0·66	34·59	27·76	2·59	—	0·00	63·0	4·40	,,	5			
		200	—	1·16	34·66	27·78	2·59	—	0·00	72·7	4·12	,,	10			
		300	—	1·29	34·69	27·79	2·55	—	0·00	58·4	4·16	,,	20			
		400	—	1·34	34·70	27·81	2·57	—	0·00	71·2	4·23	,,	30			
		600^1	592	0·98	34·70	27·83	2·57	—	—	80·1	4·32	,,	50			
		800^1	—	0·76	34·70	27·85	2·57	—	—	82·2	4·39	**N 70 B**	128–0	**2329**	**2349**	KT
		990^1	—	0·63	34·70	27·85	2·57	—	—	86·1	4·40	**N 100 B**				
		1490^1	—	0·37	34·69	27·85	2·57	—	—	93·5	4·44	**N 70 B**	520–210	**2329**	**2359**	DGP
		1990^1	1994	0·16	34·68	27·86	2·57	—	—	94·4	4·64	**N 100 B**				
		2480^2	2478	−0·02	34·67	27·86	2·57	—	—	98·4	4·82	**N 100 H**	0–5	**2329**	**2359**	
		2980^2	—	−0·17	34·67	27·87	2·57	—	—	95·7	4·99					
		3470^2	—	−0·24	34·67	27·87	2·57	—	—	96·3	5·04					
		3970^2	—	−0·28	34·67	27·88	2·57	—	—	79·8	5·21					
		4470^2	4470	−0·31	34·66	27·87	2·57	—	—	89·9	5·21					
1530	18	0	—	1·32	33·96	27·21	—	—	—	—	—	**N 50 V**	100–0	0907		
												NHP	50–0	—	0930	
												N 70 B	100–0	0939	0959	KT
												N 100 B				
1531	18	0	—	1·45	33·64	26·94	1·56	—	0·31	29·9	7·46	**N 50 V**	100–0	**2015**		
		5	—	1·45	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	1·44	33·64	26·94	1·62	—	0·31	31·4	—	,,	100–50			
		20	—	1·38	33·69	26·99	1·56	—	0·31	31·0	7·51	,,	250–100			
		30	—	1·15	33·71	27·02	1·73	—	0·30	34·0	—	,,	500–250			
		40	—	−1·36	34·17	27·52	1·84	—	0·18	44·3	7·20	,,	750–500			
		50	—	−1·51	34·20	27·54	2·05	—	0·19	46·8	—	,,	1000–750			
		60	—	−1·56	34·22	27·55	2·13	—	0·21	44·1	7·15	**NHP**	50–0	—	**2220**	
		80	—	−1·66	34·23	27·57	2·13	—	0·23	45·1	—	**CWS**	0			
		100	—	−1·59	34·25	27·58	2·13	—	0·23	45·5	6·95	,,	5			
		150	—	0·35	34·47	27·68	2·43	—	0·00	56·2	5·04	,,	10			
		200	—	1·24	34·61	27·75	2·47	—	0·00	59·9	4·30	,,	20			
		300	—	1·28	34·68	27·79	2·53	—	0·00	68·6	4·23	,,	30			
		400	—	1·33	34·70	27·81	2·40	—	0·00	69·4	4·25	,,	50			
		600^1	598	1·11	34·70	27·82	2·49	—	—	73·2	4·33	**N 70 B**	110–0	**2330**	**2350**	KT
		800^1	—	0·88	34·70	27·84	2·57	—	—	88·2	4·35	**N 100 B**				
		1000^1	—	0·71	34·70	27·85	2·57	—	—	93·9	4·36	**N 70 B**	450–200	**2330**	**0000**	DGP
		1490^1	—	0·37	34·69	27·85	2·59	—	—	101·4	4·46	**N 100 B**				
		1990^1	1990	0·18	34·69	27·86	2·62	—	—	100·0	4·65	**N 100 H**	0–5	**2330**	**0000**	
		2500^2	2504	−0·01	34·68	27·87	2·64	—	—	102·0	4·85					
		3000^2	—	−0·16	34·67	27·87	2·64	—	—	103·2	4·92					
		3500^2	—	−0·25	34·67	27·87	2·64	—	—	102·4	5·04					
		3990^2	—	−0·30	34·67	27·88	2·53	—	—	102·7	5·08					
		4490^2	4487	−0·34	34·67	27·88	2·47	—	—	102·7	5·29					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1532	64° 01·1′ S, 25° 46·2′ E	1935 22 ii	0900	4974*	N × E	10	N × E	3	ors	986·6	−0·5	−0·6	mod. conf. NE swell
1533	65° 24·3′ S, 27° 07·8′ E	22 ii	2000	4804*	NE × E	12	NE × E	3	ors	980·0	0·0	−0·4	mod. NE swell
1534	66° 35·3′ S, 28° 26·1′ E	23 ii	0900	4298*	E × N	9	E × N	2	c	986·8	−1·1	−1·9	mod. E × N swell
1535	67° 18′ S, 30° 34·1′ E	23 ii	2000	3694*	E	2	—	0–1	o	990·6	−4·2	−4·3	mod. E swell
1536	66° 03·4′ S, 31° 46·8′ E	24 ii	0900	4171*	E × S	6	E × S	2	o	987·4	−3·9	−4·0	mod. conf. E and NW swells
1537	64° 33·6′ S, 33° 09·4′ E	24 ii	2000	3884*	SE × S	12	SE × S	2	o	983·3	−1·0	−1·0	mod. SE swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³				O₂ c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N₂	Nitrite N₂	Si				From	To	
1532	19	0	—	1·45	33·75	27·03	—	—	—	—	—	**N 50 V**	100–0	0905	—	−0 hour 15 minutes
												NHP	50–0	—	0917	
												N 70 B **N 100 B**	124–0	0925	0945	KT
1533	19	0	—	0·65	33·96	27·25	1·56	—	0·26	26·4	7·69	**N 50 V**	100–0	**2010**	—	−1 hour
		5	—	0·65	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·65	33·96	27·25	1·54	—	0·26	28·2	—	,,	100–50			
		20	—	0·64	33·96	27·26	1·58	—	0·26	27·5	7·69	,,	250–100			
		30	—	0·51	33·96	27·26	1·56	—	0·25	28·2	—	,,	500–250			
		40	—	−1·16	34·17	27·51	1·82	—	0·15	40·0	7·58	,,	750–500			
		50	—	−1·46	34·30	27·62	2·09	—	0·14	42·5	—	,,	1000–750			
		60	—	−1·53	34·35	27·67	2·34	—	0·18	47·9	6·74	**NHP**	50–0	—	**2143**	
		80	—	−1·15	34·43	27·72	2·47	—	0·11	50·4	—	**CWS**	0			
		100	—	0·00	34·51	27·73	2·55	—	0·09	53·8	5·23	,,	5			
		150	—	1·02	34·61	27·76	2·59	—	0·00	72·3	4·27	,,	10			
		200	—	1·16	34·66	27·78	2·59	—	0·00	76·6	4·23	,,	20			
		300	—	1·38	34·69	27·79	2·60	—	0·00	80·8	4·19	,,	30			
		400	—	1·50	34·70	27·80	2·57	—	0·00	81·9	4·24	,,	50			
		600^1	599	1·10	34·70	27·82	2·60	—	—	83·6	4·25	**N 70 B**	95–0	**2317**	**2337**	KT
		800^1	—	0·88	34·70	27·84	2·60	—	—	85·3	4·43	**N 100 B**				
		1000^1	—	0·71	34·70	27·85	2·60	—	—	92·5	4·36	**N 70 B**	400–220	**2317**	**2347**	DGP
		1500^1	—	0·37	34·69	27·85	2·60	—	—	97·5	4·49	**N 100 B**				
		2000^1	2012	0·17	34·68	27·86	2·60	—	—	100·0	4·70	**N 100 H**	0–5	**2317**	**2347**	
		2500^2	2505	−0·01	34·68	27·87	2·59	—	—	100·3	4·87					
		3000^2	—	−0·14	34·67	27·87	2·60	—	—	99·2	5·11					
		3500^2	—	−0·21	34·67	27·87	2·60	—	—	96·1	5·05					
		3990^2	—	−0·29	34·66	27·87	2·60	—	—	89·1	5·11					
		4490^2	4485	−0·31	34·66	27·87	2·60	—	—	90·9	5·28					
1534	20	0	—	−0·25	33·30	26·76	—	—	—	—	—	**N 50 V**	100–0	0906		
												NHP	50–0	—	0918	
												N 70 B **N 100 B**	119–0	0925	0945	KT
1535	20	0	—	−1·64	32·94	26·52	1·86	—	0·24	46·7	7·73	**N 50 V**	100–0	**2007**		
		5	—	−1·66	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	−1·65	33·10	26·65	1·92	—	0·21	46·1	—	,,	100–50			
		20	—	−1·40	33·76	27·18	2·19	—	0·14	47·8	7·33	,,	250–100			
		30	—	−1·45	34·21	27·55	2·22	—	0·08	47·8	—	,,	500–250			
		40	—	−1·50	34·23	27·57	2·22	—	0·06	48·2	7·07	,,	750–500			
		50	—	−1·63	34·32	27·64	2·22	—	0·07	49·2	—	,,	1000–750			
		60	—	−1·66	34·38	27·69	2·36	—	0·07	49·6	6·82	**NHP**	50–0	—	**2214**	
		80	—	−1·71	34·40	27·71	2·43	—	0·11	49·7	—	**CWS**	0			
		100	—	−1·56	34·42	27·71	2·43	—	0·11	50·2	6·57	,,	5			
		150	—	−0·04	34·55	27·77	2·59	—	0·00	59·8	5·12	,,	10			
		200	—	0·82	34·65	27·79	2·57	—	0·00	70·9	4·44	,,	20			
		300	—	1·18	34·69	27·80	2·57	—	0·00	73·8	4·28	,,	30			
		395	—	1·39	34·70	27·80	2·59	—	0·00	76·6	4·29	,,	50			
		590^1	593	0·91	34·70	27·84	2·59	—	—	82·2	4·46					
		790^1	—	0·68	34·69	27·83	2·59	—	—	85·3	4·54	**N 70 B**	100–0	**2251**	**2311**	KT
		990^1	985	0·48	34·68	27·84	2·59	—	—	88·5	4·57	**N 100 B**				
		1490^2	1494	0·17	34·67	27·85	2·59	—	—	93·5	4·65	**N 70 B**	420–260	**2251**	**2321**	DGP
		1990^2	—	−0·06	34·67	27·86	2·59	—	—	94·7	4·89	**N 100 B**				
		2490^2	—	−0·17	34·67	27·87	2·59	—	—	88·5	4·96	**N 100 H**	0–5	**2251**	**2321**	
		2990^2	—	−0·23	34·66	27·86	2·60	—	—	86·4	5·07					
		3490^2	3487	−0·29	34·66	27·87	2·60	—	—	87·3	5·18					
1536	21	0	—	−0·50	33·21	26·70	—	—	—	—	—	**N 50 V**	100–0	0906		
												NHP	50–0	—	0918	
												N 70 B **N 100 B**	143–0	0925	0945	KT
1537	21	0	—	0·63	33·79	27·13	1·94	—	0·31	37·4	7·43	**N 50 V**	100–0	**2008**		
		5	—	0·55	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·50	33·79	27·13	1·96	—	0·31	41·8	—	,,	100–50			
		20	—	−0·06	33·93	27·26	2·13	—	0·26	47·8	7·26	,,	250–100			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1537 *cont.*	64° 33·6′ S, 33° 09·4′ E	1935 24 ii											
1538	63° 23·8′ S, 34° 23·3′ E	25 ii	0900	4932*	E × S	4	E × S	0–1	c	986·1	1·0	0·6	low E × S swell
1539	62° 02·1′ S, 35° 54·5′ E	25–26 ii	2000	5093*	Lt airs	2	—	0–1	o	988·1	0·4	−0·2	low conf. swell
1540	63° 03·5′ S, 37° 28·5′ E	26 ii	0900	4914*	NE × N	8	NE × N	3	o	983·4	1·4	1·1	mod. conf. NE × N swell
1541	64° 26·6′ S, 39° 17·7′ E	26–27 ii	2000	4731*	NE × E	21	NE × E	4	osq	984·2	0·0	−0·8	heavy NE × E swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.^{3}				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1537 *cont.*	21	30	—	−0·91	34·10	27·44	2·20	—	0·15	50·0	—	**N 70 V**	500–250			
		40	—	−1·56	34·25	27·58	2·30	—	0·10	50·9	6·27	,,	750–500			
		50	—	−1·54	34·30	27·62	2·43	—	0·11	52·9	—	,,	1000–750			
		60	—	−1·66	34·31	27·63	2·43	—	0·09	54·1	6·19	**NHP**	50–0	—	**2144**	
		80	—	−1·60	34·34	27·66	2·43	—	0·08	54·6	—	**CWS**	0			
		100	—	−1·35	34·39	27·70	2·43	—	<0·04	55·3	6·20	,,	5			
		150	—	1·01	34·65	27·78	2·53	—	0·00	70·1	4·31	,,	10			
		200	—	1·18	34·67	27·79	2·55	—	0·00	71·6	4·27	,,	20			
		300	—	1·22	34·69	27·80	2·43	—	0·00	74·2	4·33	,,	30			
		400	—	1·28	34·70	27·81	2·43	—	0·00	77·1	4·32	,,	50			
		600[1]	598	1·02	34·70	27·83	2·47	—	—	81·2	4·41	**N 70 B**	91–0	**2241**	**2301**	KT
		800[1]	—	0·78	34·69	27·83	2·47	—	—	82·2	4·58	**N 100 B**				
		1000[1]	1005	0·59	34·69	27·84	2·53	—	—	84·6	4·54	**N 70 B**	340–160	**2241**	**2311**	DGP
		1490[2]	1480	0·25	34·69	27·86	2·60	—	—	97·7	4·61	**N 100 B**				
		1980[2]	—	0·01	34·67	27·86	2·60	—	—	97·2	4·83	**N 100 H**	0–5	**2241**	**2312**	
		2480[2]	—	−0·14	34·67	27·87	2·60	—	—	99·1	5·13					
		2970[2]	—	−0·21	34·67	27·87	2·60	—	—	98·8	5·05					
		3470[2]	3476	−0·25	34·67	27·87	2·60	—	—	97·1	5·20					
1538	22	0	—	1·25	33·83	27·12	—	—	—	—	—	**N 50 V**	100–0	0906	—	−1 hour 15 minutes
												NHP	50–0	—	0918	
												N 70 B	146–0	0925	0945	KT
												N 100 B				
1539	22	0	—	1·51	33·70	26·99	1·71	—	0·31	35·0	7·35	**N 50 V**	100–0	2008	—	−2 hours
		5	—	1·51	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	1·47	33·70	26·99	1·73	—	0·31	36·0	—	,,	100–50			
		20	—	1·39	33·70	27·00	1·79	—	0·31	37·4	7·39	,,	250–100			
		30	—	1·25	33·70	27·01	1·77	—	0·31	41·3	—	,,	500–250			
		40	—	−1·15	34·13	27·47	2·09	—	0·15	44·1	6·93	,,	750–500			
		50	—	−1·44	34·19	27·54	2·28	—	0·18	46·8	—	,,	1000–750			
		60	—	−1·53	34·22	27·55	2·28	—	0·19	48·3	7·10	**NHP**	50–0	—	**2140**	
		80	—	−1·51	34·23	27·57	2·28	—	0·18	48·2	—	**CWS**	0			
		100	—	−0·58	34·34	27·63	2·38	—	0·17	48·3	6·12	,,	5			
		150	—	1·17	34·58	27·72	2·70	—	<0·04	64·1	4·37	,,	10			
		200	—	1·36	34·61	27·74	2·74	—	0·00	66·3	4·20	,,	20			
		300	—	1·55	34·67	27·76	2·66	—	0·00	69·1	4·16	,,	30			
		400[1]	—	1·60	34·71	27·80	2·51	—	0·00	73·0	4·24	,,	50			
		600[1]	—	1·39	34·70	27·80	2·20	—	—	76·1	4·31	**N 70 B**	91–0	**2335**	**2355**	KT
		800[2]	796	1·14	34·70	27·82	2·51	—	—	81·9	4·37	**N 100 B**				
		1000[2]	—	0·91	34·70	27·84	2·51	—	—	88·1	4·40	**N 70 B**	350–230	**2335**	**0005**	DGP
		1500[2]	—	0·51	34·69	27·84	2·62	—	—	90·4	4·43	**N 100 B**				
		2000[2]	—	0·27	34·68	27·86	2·68	—	—	95·9	4·56	**N 100 H**	0–5	**2335**	**0005**	
		2500[2]	2505	0·08	34·67	27·86	2·68	—	—	100·0	4·86					
		2970[3]	2956	0·05	34·67	27·86	2·64	—	—	100·5	4·91					
		3470[3]	—	−0·24	34·67	27·87	2·64	—	—	101·0	5·00					
		3960[3]	—	−0·27	34·67	27·87	2·64	—	—	100·7	5·15					
		4460[3]	—	−0·33	34·66	27·87	2·64	—	—	96·9	5·17					
		4960[3]	4971	−0·34	34·66	27·87	2·64	—	—	102·7	5·23					
1540	23	0	—	1·25	33·73	27·03	—	—	—	—	—	**N 50 V**	100–0	0904		
												NHP	50–0	—	0917	
												N 70 B	119–0	0924	0944	KT
												N 100 B				
1541	23	0	—	0·55	33·84	27·16	2·01	—	0·33	42·9	7·52	**N 70 V**	50–0	**2009**		
		5	—	0·55	—	—	—	—	—	—	—	,,	100–50			
		10	—	0·55	33·84	27·16	2·01	—	0·32	43·4	—	,,	250–100			
		20	—	0·46	33·84	27·17	2·01	—	0·32	43·7	7·49	,,	500–250			
		30	—	−0·26	33·96	27·30	2·01	—	0·25	45·7	—	,,	750–500			
		40	—	−1·21	34·22	27·54	2·01	—	0·16	46·8	7·29	,,	1000–750			
		50	—	−1·46	34·27	27·60	2·01	—	0·17	46·6	—	**NHP**	50–0	—	**2145**	
		60	—	−1·56	34·31	27·63	2·03	—	0·18	48·0	7·04	**CWS**	0			
		80	—	−1·49	34·32	27·64	2·15	—	0·20	48·5	—	,,	5			
		100	—	0·38	34·52	27·72	2·49	—	0·16	63·2	4·87	,,	10			
		150	—	1·27	34·63	27·75	2·66	—	0·00	69·4	4·15	,,	20			
		200	—	1·42	34·68	27·78	2·53	—	0·00	72·1	4·12	,,	30			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1541 *cont.*	64° 26·6′ S, 39° 17·7′ E	1935 26–27 ii											
1542	65° 16·4′ S, 40° 27·7′ E	27 ii	0900	4503*	ENE	27	ENE	6	o	988·4	−0·1	−0·6	heavy NE swell
1543	66° 29·7′ S, 42° 26′ E	27 ii	2000	3506*	ENE	16	ENE	3	o	993·4	−2·7	−2·7	heavy conf. ENE swell
1544	65° 29·3′ S, 43° 12·7′ E	28 ii	0900	3747*	NE	7	NE	3	c	990·0	−1·1	−1·2	mod. NE swell
1545	64° 11′ S, 44° 05·1′ E	28 ii–1 iii	2000	4254*	N×E	8	N×E	2	o	986·1	0·0	0·0	mod. conf. N×E swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S °/₀₀	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
1541 *cont.*	23	300	—	1·48	34·70	27·80	2·49	—	0·00	73·9	4·18	**CWS**	50			
		400	—	1·59	34·72	27·80	2·49	—	0·00	77·7	4·23	**N 100 B**	86–0	**2337**	**2357**	KT
		600^1	598	1·23	34·70	27·82	2·49	—	—	80·0	4·30	**N 70 B**	360–200	**2337**	**0007**	DGP
		790^1	—	1·02	34·70	27·83	2·55	—	—	94·3	4·34	**N 100 B**				
		990^1	—	0·80	34·70	27·84	2·55	—	—	97·0	4·41					
		1490^1	—	0·47	34·69	27·84	2·64	—	—	98·8	4·47					
		1980^1	1980	0·28	34·68	27·85	2·66	—	—	100·7	4·64					
		2490^2	2487	0·07	34·67	27·86	2·66	—	—	100·2	4·88					
		2990^2	—	−0·08	34·67	27·86	2·66	—	—	98·4	4·82					
		3490^2	—	−0·21	34·67	27·87	2·66	—	—	97·6	5·03					
		3990^2	—	−0·29	34·67	27·88	2·66	—	—	97·1	5·13					
		4490^2	4498	−0·35	34·67	27·88	2·66	—	—	96·8	5·15					
1542	24	0	—	0·28	33·80	27·15	—	—	—	—	—	**N 100 B**	177–0	0908	0928	KT
1543	24	0	—	−1·46	32·98	26·55	1·37	—	0·10	45·0	8·16	**N 70 V**	50–0	**2015**		
		5	—	−1·46	—	—	—	—	—	—	—	,,	100–50			
		10	—	−1·50	32·98	26·55	1·39	—	0·09	41·8	—	,,	250–100			
		20	—	−1·68	33·55	27·02	1·94	—	0·14	47·5	7·45	,,	500–250			
		30	—	−1·72	33·91	27·31	2·43	—	0·16	51·8	—	,,	750–500			
		40	—	−1·74	34·20	27·55	2·43	—	0·16	53·7	6·54	,,	1000–750			
		50	—	−1·76	34·25	27·59	2·43	—	0·21	54·3	—	**NHP**	50–0	—	**2145**	
		60	—	−1·77	34·29	27·62	2·43	—	0·18	52·3	6·44	**CWS**	0			
		80	—	−1·78	34·33	27·65	2·43	—	0·14	56·2	—	,,	5			
		100	—	−1·81	34·33	27·65	2·45	—	0·08	48·1	6·52	,,	10			
		145	—	−1·80	34·34	27·67	2·43	—	<0·04	41·1	6·69	,,	20			
		195	—	−1·66	34·37	27·68	2·43	—	<0·04	40·8	6·70	,,	30			
		290	—	0·72	34·65	27·80	2·43	—	0·00	68·2	4·61	,,	50			
		385	—	1·08	34·70	27·83	2·43	—	0·00	73·7	4·41	**N 70 B**	126–0	**2311**	**2331**	KT
		580^1	574	1·04	34·71	27·84	2·45	—	—	80·5	4·41	**N 100 B**				
		770^1	778	0·85	34·70	27·84	2·51	—	—	83·6	4·50	**N 70 B**	480–260	**2311**	**2341**	DGP
		990^2	981	0·52	34·69	27·84	2·55	—	—	85·8	4·61	**N 100 B**	480–260(–0)			
		1480^2	1481	0·28	34·69	27·85	2·64	—	—	91·6	4·58	**N 100 H**	0–5	**2311**	**2341**	
		1980^2	—	0·06	34·68	27·87	2·64	—	—	93·7	4·79					
		2470^2	—	−0·13	34·68	27·88	2·64	—	—	97·3	4·95					
		2970^2	2976	−0·22	34·67	27·87	2·64	—	—	92·3	5·12					
1544	25	0	—	0·92	33·36	26·76	—	—	—	—	—	**N 50 V**	100–0	0903		
												NHP	50–0	—	0915	
												N 70 B	172–0	0924	0944	KT
												N 100 B				
1545	25	0	—	0·06	33·46	26·88	1·73	—	0·20	35·2	7·59	**N 50 V**	100–0	**2011**		
		5	—	0·06	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	0·06	33·46	26·88	1·79	—	0·20	36·4	—	,,	100–50			
		20	—	0·06	33·46	26·88	1·81	—	0·19	38·3	7·56	,,	250–100			
		30	—	0·04	33·46	26·88	1·81	—	0·18	38·5	—	,,	500–250			
		40	—	−1·21	34·09	27·44	2·22	—	0·09	47·7	7·07	,,	750–500			
		50	—	−1·56	34·22	27·55	2·32	—	0·17	48·3	—	,,	1000–750			
		60	—	−1·56	34·25	27·58	2·47	—	0·22	48·6	6·48	**NHP**	50–0	—	**2158**	
		80	—	−0·44	34·42	27·67	2·62	—	0·19	57·9	—	**CWS**	0			
		100	—	0·93	34·58	27·74	2·74	—	0·16	71·6	4·29	,,	5			
		150	—	1·28	34·63	27·75	2·66	—	0·06	73·9	4·10	,,	10			
		200	—	1·47	34·68	27·78	2·64	—	<0·04	62·4	4·10	,,	20			
		300	—	1·51	34·70	27·80	2·64	—	0·00	66·2	4·15	,,	30			
		395	—	1·64	34·72	27·80	2·49	—	0·00	71·7	4·22	,,	50			
		590^1	601	1·29	34·72	27·82	2·47	—	—	72·2	4·36	**N 70 B**	73–0	**2309**	**2329**	KT
		790^1	—	1·07	34·71	27·84	2·55	—	—	79·2	4·38	**N 70 B**	340–220	**2309**	**2339**	DGP
		990^1	—	0·87	34·71	27·85	2·60	—	—	83·9	4·42	**N 100 B**				
		1480^1	1475	0·49	34·70	27·86	2·64	—	—	81·8	4·52	**N 100 H**	0–5	**2309**	**2339**	
		1960^2	1956	0·27	34·69	27·86	2·64	—	—	94·7	4·58	**N 100 B**	142–0	**2353**	**0013**	KT
		2450^2	—	0·02	34·68	27·87	2·64	—	—	92·7	4·82					
		2940^2	—	−0·15	34·67	27·87	2·49	—	—	91·1	5·09					
		3440^2	—	−0·23	34·67	27·87	2·64	—	—	91·5	5·13					
		3930^2	3932	−0·31	34·66	27·87	2·64	—	—	89·6	5·28					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1546	63° 09·9′ S, 42° 27·5′ E	1935 1 iii	0900	4879*	N × E	6	N × E	2	osp	978·4	0·9	0·6	mod. N × E swell
1547	61° 53·4′ S, 40° 29·8′ E	1–2 iii	2000	5144*	SW × W	6	SW × W	0–1	od	986·0	1·4	1·1	low conf. swell
1548	60° 39·8′ S, 38° 59·6′ E	2 iii	1000	5152*	W	10	W	3	bc	1000·0	2·5	1·1	mod. W swell
1549	59° 14·3′ S, 38° 04·3′ E	2–3 iii	2000	5218*	ESE	10	ESE	2	bc	995·7	0·8	−0·3	mod. ESE swell
			0000	—	ESE	22	ESE	3	bc	991·7	0·9	−0·6	mod. ESE swell
1550	56° 19·2′ S, 35° 48·8′ E	3 iii	2000	5375*	S × W	24	S × W	4	osq	984·1	0·7	0·2	heavy conf. S swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³				O₂ c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N₂	Nitrite N₂	Si				From	To	
1546	26	0	—	0·85	33·87	27·17	—	—	—	—	—	**N 50 V**	100–0	0905		
												NHP	50–0	—	0920	
												N 70 B	119–0	0928	0948	KT
												N 100 B				
1547	26	0	—	1·47	33·72	27·01	1·58	—	0·24	30·6	7·35	**N 50 V**	100–0	**2011**		
		5	—	1·45	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	1·42	33·72	27·02	1·31	—	0·23	30·9	—	,,	100–50			
		20	—	1·37	33·72	27·02	1·48	—	0·24	30·5	7·35	,,	250–100			
		30	—	1·28	33·72	27·03	1·52	—	0·24	31·1	—	,,	500–250			
		40	—	−1·19	33·99	27·37	1·84	—	0·16	40·0	7·74	,,	750–500			
		50	—	−1·38	34·05	27·42	1·84	—	0·17	42·7	—	,,	1000–750			
		60	—	−1·55	34·08	27·45	2·15	—	0·21	43·9	7·40	**NHP**	50–0	—	**2135**	
		80	—	−1·56	34·14	27·50	2·22	—	0·26	48·9	—	**CWS**	0			
		100	—	−1·46	34·15	27·51	2·30	—	0·22	49·9	7·01	,,	5			
		150	—	0·05	34·37	27·62	2·47	—	<0·04	53·0	5·50	,,	10			
		200	—	1·34	34·58	27·71	2·49	—	0·00	63·0	4·30	,,	20			
		300	—	1·65	34·66	27·75	2·30	—	0·00	66·5	4·09	,,	30			
		395	—	1·64	34·70	27·79	2·47	—	0·00	68·9	4·16	,,	50			
		590	—	1·63	34·72	27·80	2·28	—	—	69·5	4·29	**N 70 B**	125–0	**2334**	**2354**	KT
		790^1	786	1·33	34·72	27·82	2·30	—	—	74·3	4·33	**N 100 B**				
		990^1	—	1·08	34·71	27·84	2·30	—	—	87·4	4·41	**N 70 B**	450–190	**2334**	**0004**	DGP
		1480^1	1473	0·67	34·70	27·85	2·53	—	—	96·1	4·48	**N 100 B**				
		1970^1	—	0·41	34·69	27·85	2·41	—	—	97·9	4·59	**N 100 H**	0–5	**2334**	**0004**	
		2470^1	2482	0·20	34·69	27·86	2·57	—	—	103·5	4·84					
		2940^2	2937	0·03	34·68	27·87	2·57	—	—	102·2	4·95					
		3430^2	—	−0·13	34·67	27·87	2·57	—	—	103·3	4·98					
		3920^2	3915	−0·22	34·67	27·87	2·57	—	—	101·0	5·05					
		4420^2	—	−0·31	34·66	27·87	2·36	—	—	99·3	5·26					
		4910^2	4931	−0·31	34·66	27·87	2·49	—	—	96·7	5·18					
1548	27	0	—	1·55	33·74	27·02	—	—	—	—	—	**N 50 V**	100–0	1003		
												NHP	50–0	—	1017	
												N 70 B	106–0	1024	1044	KT
												N 100 B				
1549	27	0	—	1·79	33·58	26·88	1·96	—	0·37	27·1	7·40	**N 50 V**	100–0	**2017**		
		5	—	1·77	—	—	—	—	—	—	—	**N 70 V**	50–0			
		10	—	1·75	33·58	26·88	1·96	—	0·36	29·1	—	,,	100–50			
		20	—	1·62	33·58	26·89	2·00	—	0·35	31·2	7·46	,,	250–100			
		30	—	1·57	33·58	26·90	2·07	—	0·36	31·3	—	,,	500–250			
		40	—	1·40	33·65	26·96	1·98	—	0·31	32·2	7·48	,,	750–500			
		50	—	−0·15	33·86	27·21	2·01	—	0·22	33·0	—	,,	1000–750			
		60	—	−0·66	33·96	27·32	2·07	—	0·20	34·8	7·89	**NHP**	50–0	—	**2147**	
		80	—	−1·29	34·02	27·39	2·26	—	0·26	39·7	—	**CWS**	0			
		100	—	−1·22	34·09	27·44	2·38	—	0·22	42·7	7·32	,,	5			
		150	—	0·28	34·32	27·57	2·57	—	0·00	47·1	5·67	,,	10			
		200	—	1·13	34·46	27·62	2·68	—	0·00	51·9	4·70	,,	20			
		295	—	1·71	34·61	27·71	2·68	—	0·00	60·3	4·09	,,	30			
		395	—	1·77	34·69	27·76	2·62	—	0·00	61·3	4·10	,,	50			
		590	—	1·72	34·72	27·79	2·59	—	—	61·9	4·27	**N 70 B**	69–0	**2339**	**2359**	KT
		790^1	799	1·52	34·73	27·82	2·55	—	—	67·8	4·34	**N 100 B**				
		980^1	—	1·30	34·72	27·82	2·62	—	—	72·6	4·40	**N 100 H**	0–5	**2339**	**2359**	
		1470^1	1469	0·80	34·71	27·85	2·62	—	—	76·5	4·48	**N 70 B**	250–130	**2339**	**0009**	DGP
		1970^1	—	0·47	34·70	27·86	2·70	—	—	78·0	4·50	**N 100 B**	250–130(–0)			
		2460^1	2456	0·28	34·70	27·87	2·76	—	—	86·0	4·64					
		2960^2	2963	0·07	34·69	27·87	2·76	—	—	90·9	4·75					
		3450^2	—	−0·13	34·68	27·88	2·74	—	—	101·2	4·87					
		3940^2	3922	−0·21	34·67	27·87	2·76	—	—	98·2	5·04					
		4440^2	—	−0·27	34·66	27·86	2·64	—	—	98·2	5·16					
		4930^2	4967	−0·31	34·66	27·87	2·64	—	—	94·5	5·28					
1550	28	0	—	1·65	33·85	27·10	1·67	—	0·28	28·8	7·38	**N 70 V**	50–0	**2039**		
		5	—	1·65	—	—	—	—	—	—	—	,,	100–50			
		10	—	1·66	33·85	27·10	1·79	—	0·28	28·0	—	,,	250–100			
		20	—	1·66	33·85	27·10	1·77	—	0·29	28·9	7·38	,,	250–0			
		30	—	1·66	33·85	27·10	1·79	—	0·28	28·2	—	,,	500–250			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1550 *cont.*	56° 19·2′ S, 35° 48·8′ E	1935 3 iii											
1551	53° 48·2′ S, 33° 53′ E	4–5 iii	2000	5404*	E × N	24	E × N	4	orq	1000·5	2·8	2·5	heavy conf. E swell
1552	51° 11′ S, 32° 55·2′ E	6 iii	0900	4908*	W × S	12	W × S	4	c	1008·6	2·8	2·2	mod. conf. W × S swell
			1300	—	W × S	15	W × S	4	c	1009·1	3·3	3·0	mod. conf. W swell
1553	49° 35·1′ S, 30° 44·4′ E	7 iii	0900	3990*	NW	20	NW	5	ome	1010·2	7·0	6·8	mod. conf. NW swell
	49° 35·3′ S, 30° 44′ E		1200	—	NW	30	NW	6	omd	1006·4	7·2	7·1	heavy NW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.^{3}				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1550 *cont.*	28	40	—	1·65	33·85	27·10	1·79	—	0·29	28·3	7·36	**N 70 V**	750–500			
		50	—	1·15	33·95	27·21	2·11	—	0·29	33·6	—	,,	1000–750			
		60	—	−0·35	34·00	27·34	2·26	—	0·28	40·0	7·43	**NHP**	50–0	—	**2217**	
		80	—	−0·36	34·09	27·41	2·34	—	0·29	46·6	—	**CWS**	0			
		100	—	0·37	34·20	27·46	2·49	—	0·00	46·1	6·37	,,	5			
		150	—	1·35	34·38	27·55	2·66	—	0·00	51·2	4·88	,,	10			
		200	—	1·33	34·43	27·59	2·66	—	0·00	54·8	4·76	,,	20			
		295	—	1·87	34·57	27·66	2·64	—	0·00	59·0	4·05	,,	30			
		395	—	2·06	34·64	27·70	2·62	—	0·00	63·5	4·01	,,	50			
		590^1	584	1·91	34·70	27·77	2·43	—	—	64·4	4·09	**N 70 B**	110–0	**2225**	**2245**	KT. **N 70 B** torn
		790^1	—	1·76	34·73	27·80	2·41	—	—	63·9	4·14	**N 100 B**				
		990^1	—	1·60	34·73	27·81	2·41	—	—	70·9	4·42	**N 100 H**	0–5	**2224**	**2245**	
		1480^1	1493	1·03	34·72	27·84	2·41	—	—	80·5	4·46					
1551	29	0	—	2·29	33·92	27·11	1·73	—	0·29	20·8	7·31	**N 70 V**	50–0	**2011**		
		5	—	2·31	—	—	—	—	—	—	—	,,	100–50			
		10	—	2·30	33·92	27·11	2·01?	—	0·29	21·2	—	,,	250–100			
		20	—	2·28	33·92	27·11	1·86	—	0·29	21·2	7·30	,,	500–250			
		30	—	2·25	33·92	27·11	1·86	—	0·29	21·4	—	,,	750–500			
		40	—	2·25	33·92	27·11	1·96	—	0·29	21·1	7·31	,,	1000–750			
		50	—	2·21	33·92	27·12	1·96	—	0·29	21·6	—	**NHP**	50–0	—	**2140**	
		60	—	2·15	33·92	27·12	1·96	—	0·29	21·9	7·29	**CWS**	0			
		80	—	1·54	33·96	27·20	2·09	—	0·28	24·6	—	,,	5			
		95	—	0·21	34·02	27·33	2·38	—	0·26	34·9	7·31	,,	10			
		145	—	0·38	34·16	27·43	2·45	—	0·13	37·5	6·40	,,	20			
		195	—	1·36	34·33	27·50	2·70	—	0·00	43·8	5·00	,,	50			
		290	—	1·67	34·43	27·56	2·70	—	0·00	47·7	4·34	,,	100			
		390	—	1·68	34·52	27·63	2·76	—	0·00	49·0	4·26	**N 70 B**	182–0	**2355**	**0015**	KT
		580	—	2·05	34·65	27·71	2·47	—	—	55·0	4·04	**N 100 B**				
		770^1	764	2·00	34·71	27·77	2·45	—	—	56·5	4·09	**N 100 H**	0–5	**2355**	**0015**	
		970^1	—	2·02	34·78	27·82	2·34	—	—	56·9	4·35					
		1450^1	1457	1·60	34·77	27·84	2·26	—	—	58·6	4·48					
		1930^1	—	1·03	34·73	27·85	2·47	—	—	70·6	4·51					
		2420^1	—	0·64	34·70	27·85	2·70	—	—	79·1	4·55					
		2920^2	—	0·38	34·69	27·85	2·70	—	—	79·1	4·59					
		3410^2	—	0·13	34·69	27·86	2·68	—	—	94·6	4·80					
		3890^2	3870	−0·04	34·69	27·87	2·70	—	—	95·2	4·94					
		4380^2	—	−0·17	34·67	27·87	2·70	—	—	98·1	5·03					
		4870^2	4888	−0·20	34·66	27·86	2·64	—	—	91·1	5·11					
1552	1	0	—	2·82	33·88	27·04	1·86	—	0·27	16·3	7·37	**N 70 V**	50–0	0907		
		5	—	2·82	—	—	—	—	—	—	—	,,	100–50			
		10	—	2·82	33·88	27·04	1·86	—	0·27	16·2	—	,,	250–100			
		20	—	2·81	33·88	27·04	1·84	—	0·28	16·2	7·32	,,	500–250			
		30	—	2·80	33·88	27·04	1·90	—	0·26	16·6	—	,,	750–500			
		40	—	2·77	33·88	27·04	2·03	—	0·26	16·8	7·27	,,	1000–750			
		50	—	2·74	33·88	27·04	2·09	—	0·27	16·9	—	**NHP**	50–0	—	1029	
		60	—	2·65	33·88	27·05	2·07	—	0·26	16·8	7·29	**CWS**	0			
		80	—	2·47	33·90	27·08	2·15	—	0·26	16·8	—	,,	5			
		100	—	1·77	33·91	27·14	2·28	—	0·27	19·8	7·28	,,	10			
		150	—	0·63	33·99	27·29	2·38	—	0·21	29·2	7·23	,,	20			
		200	—	0·62	34·07	27·35	2·53	—	0·11	35·1	6·57	,,	50			
		300	—	1·90	34·34	27·48	2·74	—	0·00	43·9	4·63	,,	100			
		400	—	2·32	34·43	27·51	2·74	—	0·00	54·3	4·12	**N 70 B**	146–0	1335	1355	KT
		600^1	579	2·08	34·55	27·63	2·74	—	—	59·8	3·95	**N 100 B**				
		790^1	—	2·23	34·63	27·68	2·68	—	—	62·8	4·03					
		990^1	997	2·33	34·73	27·75	2·51	—	—	63·8	4·24					
		1490^1	—	2·04	34·79	27·82	2·30	—	—	63·4	4·46					
		1980^1	1990	1·31	34·73	27·83	2·62	—	—	74·7	4·52					
1553	2	0	—	5·05	33·95	26·86	1·67	—	0·25	<4·2	6·97	**N 70 V**	50–0	0912		
		5	—	5·02	—	—	—	—	—	—	—	,,	100–50			
		10	—	4·98	33·95	26·87	1·67	—	0·25	<4·2	—	,,	250–100			
		20	—	4·97	33·95	26·87	1·67	—	0·25	<4·2	6·80	,,	500–250			
		30	—	4·97	33·95	26·87	1·67	—	0·25	<4·2	—	,,	750–500			
		40	—	4·96	33·95	26·87	1·69	—	0·25	<4·2	6·79	,,	1000–750			
		50	—	4·95	33·95	26·87	1·63	—	0·24	<4·2	—	**NHP**	50–0	—	1040	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1553	49° 35·1′ S, 30° 44·4′ E	1935 7 iii											
cont.	49° 35·3′ S, 30° 44′ E												
1554	38° 02·9′ S, 18° 39·7′ E	28 iii	1700	4620*	WSW	26	W × S	4–6	bc	1009·3	15·1	12·8	heavy conf. swell
			2100	—	SW × W	26	SW × W	4	bcqrp	1009·9	14·9	12·2	heavy conf. SW swell
1555	39° 51·6′ S, 18° 41·8′ E	29 iii	1700	4925*	SSW	15	S × W	3–4	bc	1017·4	15·0	12·3	mod. conf. S swell
			2100	—	SSW	15	SSW	3	c	1019·7	14·7	12·9	mod. conf. S swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S °/₀₀	σt	Mg.—atom m.^{3}				O$_2$ c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N$_2$	Nitrite N$_2$	Si				From	To	
1553	2	60	—	4·95	33·95	26·87	1·63	—	0·24	<4·2	6·73	**CWS**	0			
cont.		80	—	4·93	33·95	26·87	1·65	—	0·24	<4·2	—	,,	5			
		100	—	4·55	33·95	26·91	1·65	—	0·26	5·0	6·82	,,	10			
		150	—	4·06	34·03	27·04	1·82	—	0·09	10·1	6·50	,,	20			
		200	—	2·96	34·03	27·14	2·00	—	0·00	11·1	6·79	,,	50			
		295	—	2·37	34·03	27·19	2·13	—	0·00	16·5	6·71	,,	100			
		395	—	2·62	34·14	27·26	2·13	—	0·00	20·4	5·93					
		590^1	592	2·36	34·31	27·41	2·59	—	—	24·8	4·88					
		790^1	—	2·39	34·42	27·49	2·70	—	—	34·3	4·30					
		980^1	981	2·38	34·55	27·61	2·72	—	—	52·0	3·99					
		1480^2	1479	2·30	34·72	27·74	2·53	—	—	57·8	3·97					
		1970^2	—	2·19	34·78	27·80	2·40	—	—	58·4	4·43					
		2460^2	2468	1·76	34·79	27·85	2·40	—	—	65·5	4·49					
		2950^2	—	1·31	34·75	27·85	2·53	—	—	77·7	4·32					
		3440^2	3427	0·88	34·72	27·85	2·74	—	—	84·0	4·60					
1554	24	0	—	19·65	35·57	25·31	0·00	—	0·00	<4·2	4·88	**TYFB**	1500–0	**2105**	**2232**	DGP
		5	—	19·70												
		10	—	19·70	35·57	25·30	0·00	—	0·00	<4·2						
		20	—	19·70	35·57	25·30	0·00	—	0·00	<4·2	4·88					
		30	—	19·70	35·57	25·30	0·00	—	0·00	<4·2						
		40	—	19·70	35·57	25·30	0·00	—	0·00	<4·2	4·87					
		50	—	19·70	35·57	25·30	0·00	—	0·00	<4·2						
		60	—	19·70	35·57	25·30	0·00	—	0·00	<4·2	4·89					
		80	—	19·70	35·57	25·30	0·00	—	0·00	<4·2						
		100	—	19·70	35·57	25·30	0·00	—	0·00	<4·2	4·85					
		150	—	18·53	35·53	25·57	0·17	—	0·00	<4·2	4·39					
		200	—	17·63	35·52	25·77	0·27	—	0·00	<4·2	4·34					
		300	—	15·98	35·45	26·11	0·51	—	0·00	<4·2	4·22					
		400	—	14·45	35·36	26·39	0·53	—	0·00	7·4	4·36					
		590^1	595	12·14	35·14	26·69	0·76	—	—	7·5	4·46					
		790^1	—	9·85	34·80	26·85	1·14	—	—	10·0	4·77					
		990^1	—	7·01	34·57	27·10	1·84	—	—	16·8	4·26					
		1490^1	—	3·51	34·53	27·49	2·64	—	—	45·4	3·76					
		1980^1	1984	2·76	34·74	27·72	2·30	—	—	47·0	4·13					
		2440^2	—	2·66	34·82	27·80	2·13	—	—	38·5	4·67					
		2930^2	2929	2·48	34·84	27·83	1·96	—	—	42·9	4·77					
		3420^2	—	2·26	34·86	27·86	1·96	—	—	47·3	4·83					
		3910^2	—	1·73	34·80	27·86	2·11	—	—	52·0	4·72					
		4390^2	4393	1·12	34·73	27·84	2·34	—	—	67·9	4·35					
1555	25	0	—	19·40	35·57	25·37	0·00	—	0·04	<4·2	4·89	**N 70 B**	1000–0	**2046**	**2216**	DGP
		5	—	19·40	—	—	—	—	—	—	—	**TYFB**				
		10	—	19·40	35·57	25·37	0·00	—	<0·04	<4·2						
		20	—	19·40	35·57	25·37	0·00	—	<0·04	<4·2	4·89					
		30	—	19·40	35·57	25·37	0·00	—	<0·04	<4·2						
		40	—	19·40	35·57	25·37	0·00	—	<0·04	<4·2	4·90					
		50	—	19·40	35·57	25·37	0·00	—	<0·04	<4·2						
		60	—	19·40	35·57	25·37	0·00	—	<0·04	<4·2	4·91					
		80	—	19·40	35·57	25·37	0·00	—	<0·04	<4·2						
		100	—	19·40	35·57	25·37	0·00	—	<0·04	<4·2	4·91					
		150	—	18·22	35·53	25·65	0·36	—	<0·04	<4·2	4·48					
		200	—	17·18	35·53	25·90	0·48	—	0·00	<4·2	4·38					
		300	—	15·63	35·45	26·19	0·46	—	0·00	<4·2	4·48					
		400	—	14·25	35·37	26·44	0·59	—	0·00	7·0	4·61					
		600^1	612	11·94	35·14	26·73	0·86	—	—	7·5	4·48					
		800^1	—	9·60	34·80	26·89	1·27	—	—	9·5	4·68					
		1000^1	—	6·84	34·59	27·14	2·00	—	—	19·4	4·15					
		1500^1	—	3·17	34·47	27·47	2·68	—	—	39·7	3·97					
		2000^1	1994	2·75	34·74	27·73	2·43	—	—	42·7	4·11					
		2480^2	2479	2·64	34·82	27·80	2·09	—	—	42·5	4·57					
		2970^2	—	2·47	34·84	27·83	1·96	—	—	42·2	4·78					
		3470^2	—	2·23	34·86	27·86	2·01	—	—	43·4	4·74					
		3970^2	—	1·59	34·79	27·86	2·32	—	—	53·2	4·70					
		4460^2	4461	1·11	34·74	27·85	2·45	—	—	71·1	4·29					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1556	42° 19·9′ S, 19° 10·5′ E	1935 30 iii	1700	4965*	S	9	S	3	c	1020·5	9·7	8·9	low S swell
			2100	—	—	0	—	1	bw	1022·5	9·3	8·6	low S swell
1557	45° 17·9′ S, 18° 57·7′ E	31 iii	1700	4693*	N	10–12	N	3	od	1017·9	10·0	9·4	low N swell
			2100	—	N	10–12	N	3	cw	1015·4	10·5	9·9	low N swell
1558	47° 45′ S, 18° 50·5′ E	1 iv	1700	4775*	N×W	10	N×W	2	fe	1008·2	5·6	5·5	mod. conf. N×W swell
			2100	—	N×W	8	N×W	2	fe	1006·4	5·2	5·0	mod. conf. N×W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	Mg.—atom m.^{3}				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1556	26	0	—	11·18	34·51	26·38	0·72	—	0·15	<4·2	6·06	**N 70 B** **TYFB**	1500–0	**2051**	**2216**	DGP. –1 hour
		5	—	11·18	—	—	—	—	—	—	—					
		10	—	11·13	34·51	26·39	0·72	—	0·16	<4·2						
		20	—	11·13	34·51	26·39	0·72	—	0·16	<4·2	6·06					
		30	—	10·68	34·42	26·39	0·72	—	0·17	<4·2						
		40	—	10·68	34·42	26·39	0·80	—	0·17	<4·2	6·12					
		50	—	10·78	34·45	26·40	0·80	—	0·20	<4·2						
		60	—	11·03	34·53	26·43	0·80	—	0·19	<4·2	6·03					
		80	—	11·08	34·69	26·53	0·84	—	0·12	<4·2						
		100	—	10·78	34·76	26·64	0·89	—	0·00	<4·2	5·43					
		150	—	9·40	34·65	26·79	1·16	—	0·00	<4·2	5·37					
		200	—	8·51	34·55	26·87	1·24	—	0·00	5·7	5·44					
		300	—	7·07	34·42	26·96	1·48	—	0·00	7·7	5·44					
		400	—	5·42	34·30	27·09	1·84	—	0·00	12·1	5·43					
		600^1	600	3·77	34·21	27·20	2·20	—	—	17·2	5·40					
		800^1	—	3·67	34·37	27·34	2·57	—	—	28·9	4·50					
		1000^1	—	3·26	34·48	27·47	2·66	—	—	42·3	3·90					
		1490^1	—	2·67	34·70	27·70	2·45	—	—	48·2	3·94					
		1990^1	1991	2·59	34·79	27·78	2·09	—	—	49·9	4·60					
		2490^2	2492	2·37	34·83	27·83	1·98	—	—	50·4	4·77					
		2990^2	—	2·09	34·81	27·84	2·03	—	—	53·4	4·63					
		3490^2	—	1·57	34·78	27·85	2·30	—	—	63·2	4·61					
		3980^2	—	1·04	34·75	27·87	2·49	—	—	75·5	4·31					
		4480^2	4479	0·76	34·71	27·86	2·60	—	—	88·9	4·64					
1557	27	0	—	9·03	34·40	26·66	0·95	—	0·24	<4·2	6·23	**N 70 B** **TYFB**	1400–0	**2042**	**2208**	DGP
		5	—	9·03	—	—	—	—	—	—	—					
		10	—	9·03	34·40	26·66	0·93	—	0·25	<4·2						
		20	—	9·02	34·40	26·66	0·95	—	0·25	<4·2	6·21					
		30	—	9·02	34·40	26·66	0·95	—	0·25	<4·2						
		40	—	9·02	34·40	26·66	0·95	—	0·24	<4·2	6·23					
		50	—	9·02	34·40	26·66	1·01	—	0·24	<4·2						
		60	—	9·02	34·40	26·66	1·01	—	0·25	<4·2	6·21					
		80	—	9·03	34·42	26·67	1·01	—	0·25	<4·2						
		100	—	9·06	34·43	26·69	1·05	—	0·35	<4·2	6·17					
		150	—	8·71	34·60	26·87	1·22	—	0·00	7·1	5·72					
		200	—	6·91	34·38	26·97	1·46	—	0·00	8·5	5·96					
		300	—	6·24	34·37	27·05	1·58	—	0·00	12·1	5·42					
		400	—	5·50	34·36	27·13	1·82	—	0·00	17·3	4·98					
		600^1	593	3·68	34·31	27·29	2·43	—	—	31·4	4·79					
		800^1	—	3·04	34·39	27·42	2·66	—	—	38·7	4·16					
		1000^1	—	2·99	34·51	27·52	2·70	—	—	44·5	3·84					
		1490^1	—	2·61	34·67	27·68	2·53	—	—	50·4	4·07					
		1990^1	1992	2·45	34·78	27·78	2·15	—	—	53·9	4·56					
		2500^2	2491	2·22	34·81	27·83	2·09	—	—	56·9	4·70					
		3000^2	—	1·75	34·77	27·83	2·24	—	—	64·8	4·31					
		3500^2	—	1·27	34·74	27·84	2·40	—	—	71·6	4·50					
		4000^2	—	0·87	34·72	27·85	2·45	—	—	81·5	4·61					
		4500^2	4506	0·37	34·68	27·85	2·62	—	—	87·0	4·76					
1558	28	0	—	4·64	33·86	26·83	1·69	—	0·25	<4·2	6·95	**N 70 B** **TYFB**	1300–0	**2048**	**2215**	DGP
		5	—	4·64	—	—	—	—	—	—	—					
		10	—	4·63	33·86	26·83	1·69	—	0·25	<4·2						
		20	—	4·61	33·86	26·83	1·69	—	0·25	<4·2	6·98					
		30	—	4·57	33·86	26·83	1·71	—	0·24	<4·2						
		40	—	4·55	33·86	26·84	1·71	—	0·24	<4·2	6·95					
		50	—	4·47	33·86	26·84	1·69	—	0·23	<4·2						
		60	—	4·40	33·86	26·85	1·71	—	0·23	<4·2	6·96					
		80	—	4·12	33·89	26·91	1·73	—	0·24	<4·2						
		100	—	3·82	33·91	26·96	1·77	—	0·23	<4·2	7·03					
		150	—	3·26	33·93	27·03	1·98	—	0·26	9·4	6·85					
		195	—	2·53	34·00	27·15	2·07	—	0·00	12·6	6·67					
		290	—	2·39	34·11	27·25	2·36	—	0·00	21·3	6·08					
		385	—	2·58	34·20	27·30	2·51	—	0·00	28·1	5·37					
		580^1	576	2·36	34·33	27·42	2·81	—	—	39·4	4·43					
		770^1	—	2·32	34·45	27·52	2·81	—	—	49·6	4·06					
		970^1	—	2·32	34·59	27·64	2·81	—	—	54·3	3·75					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1558 *cont.*	47° 45′ S, 18° 50·5′ E	1935 1 iv											
1559	50° 07·2′ S, 22° 16·8′ E	2 iv	2000	4437*	W	14	W	4	od	1002·6	3·9	3·2	mod. conf. W swell
1560	51° 08·9′ S, 23° 55·3′ E	3 iv	1000	3747*	WNW	14	WNW	4	crp	1000·3	2·8	1·6	mod. conf. WNW swell
1561	49° 02·2′ S, 28° 24′ E	4 iv	1700	5428*	SW × W	18	SW × W	5	bc	1004·4	3·3	2·5	mod. conf. WSW swell
			2100	—	SW × W	18	SW × W	5	b	1007·1	2·9	2·7	mod. conf. WSW swell
1562	46° 51·7′ S, 37° 56·5′ E to 46° 54·8′ S, 37° 53·8′ E	7 iv	1010	88*	SW × W	31	SW × W	5	bchq	996·2	5·7	5·0	mod. SW × W swell
			1030	90*	—	—	—	—	—	—	—	—	
			1102	97*	—	—	—	—	—	—	—	—	
1563	46° 48·4′ S, 37° 49·2′ E	7 iv	1302	113*	SW × W	32	SW × W	6	bchq	996·2	5·6	5·0	heavy conf. SW × W swell
			1322	101*	—	—	—	—	—	—	—	—	
1564	46° 36·5′ S, 38° 02·3′ E	7 iv	1529	110*	SW × W	32	SW × W	6	bchq	1000·7	5·7	5·0	heavy SW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1558	28	1450^1	—	2·30	34·71	27·74	2·53	—	—	58·5	4·13					
cont.		1930^1	1939	2·10	34·78	27·81	2·34	—	—	60·7	4·53					
		2350^2	2333	1·77	34·78	27·84	2·34	—	—	71·1	4·55					
		2820^2	—	1·24	34·74	27·84	2·51	—	—	77·9	4·49					
		3290^2	—	0·86	34·71	27·85	2·57	—	—	88·1	4·22					
		3760^2	—	0·63	34·70	27·85	2·68	—	—	95·7	4·58					
		4230^2	4250	0·35	34·68	27·85	2·78	—	—	102·7	4·63					
1559	29	—	—	—	—	—	—	—	—	—	—	N 450 H	500(–0)	2032	2117	Net reached surface at 2150
1560	29	0	—	1·77	33·90	27·13	1·73	—	0·29	15·5	7·36	NHP	50–0	1046	1053	
		10	—	1·77	33·90	27·13	1·73	—	0·29	15·6						
		20	—	1·76	33·90	27·13	1·77	—	0·29	16·8	7·34					
		30	—	1·76	33·90	27·13	1·96	—	0·29	17·6						
		40	—	1·76	33·90	27·13	1·96	—	0·29	17·9	7·34					
		50	—	1·76	33·94	27·16	1·90	—	0·29	18·1						
		60	—	1·75	33·92	27·15	1·90	—	0·29	19·1	7·41					
		80	—	1·28	33·94	27·19	1·92	—	0·29	19·8						
		95	—	0·05	34·02	27·34	2·41	—	0·28	27·8	7·14					
		145	—	0·07	34·14	27·44	2·64	—	0·00	37·7	6·09					
		190	—	0·56	34·32	27·55	2·70	—	0·00	49·5	5·16					
		290	—	1·79	34·57	27·67	2·72	—	0·00	53·7	3·95					
		385	—	1·98	34·65	27·71	2·74	—	0·00	60·4	3·93					
		580^1	576	1·93	34·68	27·74	2·70	—	—	60·7	4·00					
		770^1	—	1·86	34·71	27·78	2·57	—	—	61·9	4·29					
		960^1	913?	1·69	34·74	27·81	2·57	—	—	66·6	4·32					
		1460^2	1459	1·17	34·74	27·85	2·64	—	—	74·9	4·42					
		1950^2	—	0·76	34·73	27·87	2·70	—	—	75·1	4·56					
		2430^2	—	0·49	34·70	27·86	2·81	—	—	81·1	4·46					
		2920^2	—	0·29	34·69	27·85	2·85	—	—	86·7	4·86					
		3410^2	3409	0·14	34·68	27·86	2·85	—	—	92·3	4·78					
1561	1	0	—	3·56	33·89	26·97	1·54	—	0·27	<4·2	7·02	NHP	50–0	1720	1726	
		10	—	3·56	33·89	26·97	1·54	—	0·27	<4·2	—	TYFB	1250–0	2107	2232	DGP
		20	—	3·56	33·89	26·97	1·54	—	0·27	<4·2	7·03					
		30	—	3·56	33·89	26·97	1·56	—	0·26	<4·2						
		40	—	3·56	33·89	26·97	1·58	—	0·26	<4·2	7·03					
		50	—	3·56	33·89	26·97	1·58	—	0·26	<4·2						
		60	—	3·56	33·89	26·97	1·58	—	0·26	<4·2	7·05					
		80	—	3·33	33·89	26·99	1·60	—	0·26	<4·2						
		100	—	2·82	33·94	27·08	1·77	—	0·25	9·9	6·91					
		150	—	1·97	34·03	27·22	2·15	—	0·00	15·5	6·60					
		200	—	1·98	34·12	27·29	2·22	—	0·00	20·4	6·00					
		295	—	2·18	34·23	27·37	2·49	—	0·00	27·6	5·08					
		395	—	2·28	34·36	27·46	2·66	—	0·00	34·4	4·51					
		590	—	2·35	34·47	27·54	2·72	—	—	44·2	4·03					
		790^1	787	2·30	34·62	27·67	2·72	—	—	52·0	3·93					
		980^1	—	2·37	34·67	27·70	2·55	—	—	52·3	3·96					
		1480^1	—	2·15	34·74	27·78	2·09	—	—	53·4	4·26					
		1970^1	—	1·75	34·75	27·82	2·30	—	—	58·7	4·46					
		2460^1	—	1·32	34·73	27·83	2·22	—	—	61·8	4·55					
		2910^2	—	0·87	34·70	27·84	2·53	—	—	72·0	4·50					
		3390^2	—	0·59	34·69	27·84	2·66	—	—	84·7	4·57					
		3880^2	—	0·34	34·69	27·85	2·68	—	—	90·4	4·41					
		4360^2	—	0·18	34·68	27·86	2·68	—	—	89·5	4·72					
		4850^2	4845	0·08	34·66	27·85	2·68	—	—	89·2	4·88					
1562	4	—	—	—	—	—	—	—	—	—	—	DC	88–93	1010	1015	
		—	—	—	—	—	—	—	—	—	—	NRL	90–97	1030	1045	
		—	—	—	—	—	—	—	—	—	—	BNR	97–104	1102	1117	
1563	4	0	—	5·50	33·90	26·77	—	—	—	—	—	DLH	113–99	1302	1307	
		—	—	—	—	—	—	—	—	—	—	BNR	101–106	1322	1327	
1564	4	—	—	—	—	—	—	—	—	—	—	DLH	110–113	1603	1608	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1565	44° 04·7′ S, 37° 21·9′ E	1935 8 iv	1700	2465*	SW × W	30	SW × W	6	crq	1005·6	6·1	5·0	heavy conf. WSW swell
1566	40° 42′ S, 36° 05·5′ E	9 iv	1700	4526*	SW	11	SW	2–3	c	1023·3	9·9	7·6	mod. conf. SW swell
1567	37° 50·1′ S, 35° 46·6′ E	10 iv	1700	5779*	W × S	12	W × S	4	bc	1018·2	17·8	15·0	mod. conf. W × S swell
1568	34° 47·6′ S, 34° 27·9′ E	11 iv	1700	2421*	S	6	S	2	cp	1020·1	18·3	15·8	low S × W swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.³				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1565	5	0	—	7·97	33·87	26·42	1·14	—	0·25	<4·2	6·47					No nets fished
		10	—	8·00	33·87	26·41	1·14	—	0·25	<4·2						
		20	—	8·01	33·87	26·41	1·14	—	0·24	<4·2	6·46					
		30	—	8·00	33·87	26·41	1·14	—	0·24	<4·2						
		40	—	8·07	33·87	26·40	1·14	—	0·24	<4·2	6·44					
		50	—	8·07	33·87	26·40	1·05	—	0·24	<4·2						
		60	—	8·05	33·87	26·40	1·18	—	0·24	<4·2	6·42					
		80	—	8·00	33·88	26·42	1·24	—	0·24	<4·2						
		100	—	6·76	33·96	26·65	1·37	—	0·55	<4·2	6·35					
		150	—	5·26	34·01	26·88	1·71	—	0·00	7·8	6·36					
		200	—	4·88	34·10	27·00	1·75	—	0·00	9·1	6·12					
		300	—	4·48	34·19	27·12	1·96	—	0·00	13·3	5·69					
		400	—	4·38	34·23	27·16	2·17	—	0·00	17·3	5·34					
1566	6	0	—	15·53	35·34	26·13	0·00	—	0·11	<4·2	5·29	**NHP**	50–0	1708	1714	−2 hours
		10	—	15·58	35·34	26·12	0·00	—	0·11	<4·2	—	**N 70 B**	1350–0	**2026**	**2155**	DGP
		20	—	15·58	35·34	26·12	0·00	—	0·11	<4·2	5·28	**TYFB**				
		30	—	15·58	35·34	26·12	0·00	—	0·11	<4·2	—	**N 70 H**	0–5	**2026**	**2156**	
		40	—	15·58	35·34	26·12	0·00	—	0·11	<4·2	5·29					
		50	—	15·58	35·34	26·12	0·00	—	0·11	<4·2						
		60	—	15·58	35·34	26·12	0·00	—	0·10	<4·2	5·28					
		80	—	13·73	35·17	26·40	0·48	—	0·00	<4·2						
		100	—	13·10	35·10	26·47	0·65	—	0·00	5·0	4·95					
		150	—	11·80	35·06	26·69	0·68	—	0·00	6·7	4·93					
		200	—	11·01	35·00	26·79	0·84	—	0·00	7·7	4·93					
		300	—	9·57	34·79	26·88	1·06	—	0·00	9·7	5·09					
		400	—	8·18	34·67	27·01	1·35	—	0·00	13·0	4·95					
		600^1	593	6·37	34·54	27·17	1·90	—	—	23·8	4·40					
		800^1	—	4·60	34·47	27·32	2·34	—	—	30·2	4·20					
		1000^1	—	3·77	34·51	27·44	2·68	—	—	50·4	3·67					
		1500^1	1513	2·93	34·70	27·68	2·41	—	—	57·3	3·83					
		1970^2	1942	2·60	34·81	27·80	2·22	—	—	60·7	4·18					
		2470^2	—	2·41	34·83	27·82	2·01	—	—	52·5	4·28					
		2960^2	—	2·17	34·85	27·85	2·00	—	—	56·4	4·65					
		3450^2	—	1·60	34·82	27·89	2·19	—	—	65·8	4·60					
		3950^2	3975	1·03	34·77	27·88	2·43	—	—	83·9	4·69					
1567	7	0	—	20·10	35·62	25·23	0·00	—	<0·04	<4·2	4·84	**NHP**	50–0	1703	1708	
		10	—	20·10	35·62	25·23	0·00	—	<0·04	<4·2	—	**N 70 H**	0–5	**2044**	**2154**	
		20	—	20·10	35·62	25·23	0·00	—	<0·04	<4·2	4·85	**N 70 B**	1350–0	**2044**	**2214**	DGP
		30	—	20·10	35·62	25·23	0·00	—	<0·04	<4·2	—	**TYFB**				
		40	—	20·10	35·62	25·23	0·00	—	<0·04	<4·2	4·84					
		50	—	20·10	35·62	25·23	0·00	—	<0·04	<4·2						
		60	—	20·10	35·62	25·23	0·00	—	<0·04	<4·2	4·84					
		80	—	20·10	35·62	25·23	0·00	—	<0·04	<4·2						
		100	—	20·10	35·62	25·23	0·00	—	<0·04	<4·2	4·85					
		150	—	19·03	35·53	25·44	0·27	—	<0·04	<4·2	4·41					
		200	—	17·93	35·53	25·72	0·30	—	<0·04	<4·2	4·38					
		300	—	16·54	35·52	26·03	0·42	—	0·00	<4·2	4·40					
		395	—	15·05	35·45	26·32	0·55	—	0·00	<4·2	4·44					
		590	—	12·88	35·21	26·60	0·68	—	—	<4·2	4·68					
		790^1	792	10·19	34·90	26·86	1·10	—	—	8·4	4·69					
		990^1	—	7·95	34·66	27·03	1·63	—	—	17·2	4·19					
		1480^1	—	3·82	34·50	27·43	2·79	—	—	44·3	3·75					
		1970^1	—	2·83	34·70	27·69	2·66	—	—	47·3	3·82					
		2470^1	2463	2·56	34·81	27·80	2·30	—	—	49·9	4·33					
		2950^2	—	2·35	34·85	27·84	2·11	—	—	52·5	4·50					
		3440^2	—	1·95	34·82	27·86	2·28	—	—	59·4	4·23					
		3930^2	—	1·27	34·77	27·86	2·40	—	—	63·9	4·50					
		4420^2	—	0·76	34·74	27·88	2·62	—	—	88·5	4·56					
		4910^2	4910	0·61	34·73	27·88	2·62	—	—	93·4	4·58					
1568	8	0	—	19·80	35·61	25·30	0·00	—	<0·04	<4·2	4·91	**NHP**	50–0	1706	1711	
		10	—	19·80	35·61	25·30	0·00	—	0·00	<4·2	—	**N 70 H**	0–5	**1923**	**2033**	
		20	—	19·70	35·61	25·33	0·00	—	0·00	<4·2	4·94	**N 70 B**	1400–0	**1923**	**2048**	DGP
		30	—	19·70	35·61	25·33	0·00	—	0·00	<4·2	—	**TYFB**				
		40	—	19·70	35·61	25·33	0·00	—	0·00	<4·2	4·93					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1568 *cont.*	34° 47·6′ S, 34° 27·9′ E	1935 11 iv											
1569	31° 50·3′ S, 32° 20·5′ E	12 iv	1700	3493*	NE	10–12	NE	3–4	b	1017·2	21·7	18·4	low NE swell
1570	28° 42′ S, 39° 06·6′ E	21 iv	0900	4905*	NE × N	13	NE × N	3	c	1012·1	25·0	21·7	low conf. N swell
1571	27° 24·3′ S, 39° 21·2′ E	21 iv	2000	4570*	NNE	8	NNE	3	b	1010·2	23·3	20·6	low NNE swell
1572	24° 59·7′ S, 39° 49·8′ E	22 iv	1500	3806*	NW × N	8	NW × N	2	b	1011·4	25·6	21·7	low NW swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	P	Nitrate + Nitrite N₂	Nitrite N₂	Si	O₂ c.c. litre	Gear	Depth (metres)	From	To	
1568 *cont.*	8	50	—	19·70	35·61	25·33	0·00	—	0·00	<4·2						
		60	—	19·70	35·61	25·33	0·00	—	0·00	<4·2	4·93					
		80	—	19·65	35·61	25·34	0·00	—	0·00	<4·2						
		100	—	19·62	35·61	25·35	0·00	—	0·00	<4·2	4·87					
		150	—	18·42	35·57	25·62	0·25	—	0·00	<4·2	4·47					
		200	—	17·78	35·57	25·78	0·27	—	0·00	<4·2	4·50					
		300	—	16·54	35·54	26·06	0·25	—	0·00	<4·2	4·58					
		400	—	15·10	35·45	26·31	0·32	—	0·00	<4·2	4·49					
		590[1]	596	12·91	35·27	26·64	0·67	—	—	5·6	4·51					
		790[1]	—	10·64	34·98	26·85	1·08	—	—	8·4	4·48					
		990[1]	—	8·12	34·68	27·03	1·46	—	—	15·0	4·43					
		1480[2]	—	3·78	34·54	27·47	2·51	—	—	37·6	3·78					
		1970[2]	1971	2·89	34·75	27·72	2·36	—	—	53·7	3·70					
1569	9	0	—	22·89	35·60	24·44	0·00	—	0·00	<4·2	4·68	**NHP**	50–0	1710	1716	
		10	—	22·89	35·61	24·45	0·00	—	0·00	<4·2	—	**N 70 H**	0–5	**1930**	**2043**	
		20	—	22·89	35·61	24·45	0·00	—	0·00	<4·2	4·68	**TYFB**	1200–500	**1930**	**2112**	DGP
		30	—	22·89	35·61	24·45	0·00	—	0·00	<4·2						
		40	—	22·84	35·61	24·46	0·00	—	0·00	<4·2	4·66					
		50	—	22·39	35·61	24·59	0·00	—	0·00	<4·2						
		60	—	22·34	35·62	24·61	0·00	—	0·00	<4·2	4·71					
		80	—	21·70	35·65	24·81	0·00	—	0·00	<4·2						
		100	—	19·37	35·38	25·24	0·57?	—	0·00	<4·2	3·57					
		150	—	17·87	35·55	25·74	0·27	—	0·00	<4·2	4·44					
		200	—	16·92	35·59	26·00	0·29	—	0·00	<4·2	4·56					
		300	—	15·38	35·50	26·29	0·46	—	0·00	<4·2	4·60					
		400	—	14·05	35·39	26·49	0·46	—	0·00	<4·2	4·72					
		600[1]	600	11·94	35·17	26·76	0·89	—	—	4·9	4·68					
		800[1]	—	9·93	34·91	26·92	1·10	—	—	6·8	4·73					
		990[2]	980	7·44	34·61	27·08	1·69	—	—	16·9	4·26					
		1480[2]	—	3·94	34·58	27·48	2·70	—	—	45·5	3·43					
		1970[2]	—	2·94	34·75	27·72	2·70	—	—	48·2	3·59					
		2470[2]	—	2·55	34·82	27·81	2·53	—	—	48·8	4·12					
		2960[2]	2964	2·40	34·83	27·82	2·38	—	—	48·6	4·56					
1570	18	0	—	25·18	35·39	23·60	0·00	—	0·00	0·0	4·52	**N 50 V**	100–0	0906		
		10	—	25·18	35·39	23·60	0·00	—	0·00	0·0	—	**N 70 V**	50–0			
		20	—	25·18	35·39	23·60	0·00	—	0·00	0·0	4·51	,,	100–50			
		30	—	25·18	35·39	23·60	0·00	—	0·00	0·0	—	,,	250–100			
		40	—	25·18	35·39	23·60	0·00	—	0·00	0·0	4·52	,,	500–250			
		50	—	25·18	35·39	23·60	0·00	—	0·00	0·0	—	**NHP**	50–0	—	1000	
		60	—	25·18	35·39	23·60	0·00	—	0·00	0·0	4·53					
		80	—	23·78	35·35	23·99	0·10	—	0·10	0·0						
		95	—	22·61	35·26	24·27	0·15	—	0·09	<4·2	4·04					
		145	—	20·38	35·47	25·04	0·13	—	0·00	<4·2	4·06					
		190	—	18·64	35·59	25·58	0·15	—	0·00	<4·2	4·25					
		285	—	16·43	35·53	26·08	0·17	—	0·00	<4·2	4·58					
		385	—	14·45	35·38	26·41	0·29	—	0·00	<4·2	4·69					
		570[1]	595	12·05	35·16	26·72	0·87	—	—	6·4	4·53					
		770[1]	—	10·29	34·89	26·84	1·01	—	—	7·0	4·73					
		960[1]	959	7·92	34·64	27·03	1·46	—	—	14·5	4·42					
		1440[1]	—	3·97	34·57	27·47	2·55	—	—	40·2	3·38					
		1910[1]	1888	2·88	34·74	27·71	2·55	—	—	49·7	3·52					
		2210[2]	2190	2·62	34·79	27·78	2·43	—	—	49·8	3·64					
		2650[2]	—	2·40	34·81	27·81	2·11	—	—	49·9	4·20					
		3090[2]	—	2·11	34·82	27·85	1·90	—	—	50·5	4·46					
		3540[2]	—	1·75	34·80	27·86	2·24	—	—	55·7	4·46					
		3980[2]	3995	1·24	34·77	27·86	2·17	—	—	64·0	4·51					
1571	18	—	—	—	—	—	—	—	—	—	—	**TYFB** **N 70 B**	} 500–0	**2105**	**2205**	DGP
												N 70 H	0–5	**2105**	**2210**	
												TYFB	1450–1000	**2105**	**2230**	DGP
1572	19	0	—	25·08	35·42	23·66	0·00	9·99	0·00	0·0	4·49	**N 50 V**	100–0	1518		
		10	—	24·98	35·42	23·69	0·00	—	0·00	0·0	—	**N 70 V**	50–0			
		20	—	24·73	35·42	23·76	0·00	6·43	0·00	0·0	4·56	,,	100–50			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1572 *cont.*	24° 59·7′ S, 39° 49·8′ E	1935 22 iv											
1573	24° 35·6′ S, 39° 53·5′ E	22 iv	2000	3498*	NW × N	6–8	NW × W	2	b	1012·0	23·9	21·1	low NW swell
1574	21° 44·6′ S, 40° 33·7′ E	23 iv	1700	2996*	Lt airs	0–1	—	1	bcgl	1012·5	27·0	24·0	low SW swell
			1820	—	SSW	15	SSW	4	bcgl	1012·5	27·0	24·0	low SW swell
1575	18° 33·2′ S, 41° 35·4′ E	24 iv	1700	2147*	S	10	S	2	c	1015·0	26·7	23·3	low S swell
1576	14° 42′ S, 42° 22·2′ E	25 iv	2000	3021*	S	12	S	3	bc	1016·6	26·1	23·3	low S swell

		HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				
							Mg.—atom m.^{3}							TIME		
Station	Age of moon (days)	Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	Remarks
1572 *cont.*	19	30	—	24·59	35·42	23·81	0·00	—	0·00	0·0	—	**N 70 V**	250–100			
		40	—	24·50	35·42	23·83	0·00	7·14	0·00	0·0	4·57	,,	500–250			
		50	—	23·73	35·35	24·01	0·00	—	0·00	0·0	—	**NHP**	50–0	—	1603	
		60	—	23·09	35·36	24·20	0·00	5·71	0·00	0·0	4·67					
		80	—	21·79	35·41	24·61	0·00	9·28	0·07	0·0						
		100	—	20·92	35·44	24·87	0·13	11·42	0·06	<4·2	4·13					
		150	—	18·37	35·59	25·65	0·13	12·14	0·00	<4·2	4·15					
		200	—	16·52	35·55	26·07	0·17	11·42	0·00	<4·2	4·60					
		300	—	14·08	35·38	26·49	0·38	—	0·00	<4·2	4·50					
		395	—	12·59	35·25	26·68	0·42	26·41	0·00	<4·2	4·79					
		590^1	593	9·92	34·85	26·86	1·01	22·84	—	7·1	4·89					
		790^1	—	7·42	34·64	27·10	1·58	36·41	—	18·0	4·14					
		990^1	989	5·64	34·63	27·33	2·38	39·26	—	36·8	3·08					
		1480^2	1482	3·56	34·73	27·64	2·66	37·84	—	47·9	2·85					
		1980^2	—	2·68	34·80	27·78	2·15	—	—	49·2	3·73					
		2470^2	2481	2·35	34·82	27·83	1·67	37·84	—	48·5	4·35					
		2970^2	—	2·03	34·83	27·86	1·71	—	—	49·1	4·52					
		3460^2	3453	1·53	34·81	27·88	1·73	37·84	—	52·4	4·59					
1573	19	—	—	—	—	—	—	—	—	—	—	**TYFB**	800–0	**2056**	**2146**	Estimated depth
												N 70 H	0–5	**2056**	**2155**	
												N 70 B	1200–0	**2056**	**2214**	Estimated depth
												TYFB	2400–?	**2056**	**2310**	DGP. Net stopped fishing at unknown depth
1574	20	0	—	26·58	35·31	23·11	0·00	0·00	0·00	<4·2	4·47	**N 50 V**	100–0	**1708**		
		10	—	26·48	35·31	23·14	0·00	—	0·00	<4·2	—	**N 70 V**	50–0			
		20	—	26·38	35·31	23·17	0·00	0·00	0·00	<4·2	4·46	,,	100–50			
		30	—	26·33	35·31	23·19	0·00	—	0·00	<4·2	—	,,	250–100			
		40	—	25·38	35·30	23·48	0·00	0·71	0·00	<4·2	4·59	,,	500–250			
		50	—	24·28	35·30	23·81	0·10	—	0·00	<4·2	—	**NHP**	50–0	—	**1756**	
		60	—	23·43	35·38	24·12	0·08	0·71	0·00	<4·2	4·48	**N 70 B**	600–0	**1915**	**2010**	DGP
		80	—	21·94	35·36	24·53	0·15	1·43	0·22	<4·2	—	**TYFB**	600–0	**1915**	**2013**	
		100	—	20·57	35·47	24·99	0·21	1·43	0·07	<4·2	4·05	**N 70 H**	0–5	**1915**	**2015**	
		150	—	18·62	35·53	25·54	0·23	1·43	0·00	<4·2	4·11	**TYFB**	1100–450	**1915**	**2041**	DGP
		200	—	16·52	35·52	26·04	0·27	1·43	0·00	<4·2	4·30					
		300	—	13·73	35·29	26·49	0·70	—	0·00	10·6	3·96					
		395	—	12·14	35·15	26·70	0·65	2·86	0·00	10·5	4·32					
		590^1	588	9·97	34·88	26·88	1·05	3·57	—	12·3	4·33					
		790^1	—	7·57	34·71	27·14	1·86	8·57	—	27·0	3·19					
		980^1	974	6·59	34·75	27·30	2·53	13·56	—	41·1	2·25					
		1480^1	—	3·94	34·78	27·64	2·55	30·70	—	59·2	2·67					
		1970^1	1989	2·69	34·79	27·77	2·03	—	—	56·2	3·79					
1575	21	0	—	27·38	35·10	22·69	0·00	2·14	0·00	<4·2	4·41	**N 50 V**	100–0	**1713**		
		10	—	27·38	35·10	22·69	0·00	—	0·00	<4·2	—	**N 70 V**	50–0			
		20	—	27·38	35·10	22·69	0·00	1·43	0·00	<4·2	4·40	,,	100–50			
		30	—	27·38	35·10	22·69	0·00	—	0·00	<4·2	—	,,	250–100			
		40	—	27·28	35·10	22·73	0·00	1·43	0·00	<4·2	4·40	,,	500–250	—	**1745**	
		50	—	27·23	35·12	22·75	0·00	—	0·00	<4·2	—	**TYFB**	400–0	**1920**	**2028**	Estimated depth
		60	—	26·48	35·20	23·06	0·00	1·43	0·00	<4·2	4·52	**TYFB**	800–550	**1920**	**2035**	DGP
		80	—	23·58	35·28	24·00	0·15	2·14	0·16	4·9	—	**N 70 B**	800–0	**1920**	**2125**	
		95	—	19·81	35·32	25·07	0·57	5·71	0·08	8·4	3·44					
		145	—	15·70	35·29	26·06	0·86	14·28	0·00	11·2	3·40					
		190	—	12·46	35·17	26·66	1·05	17·13	0·00	11·2	3·92					
		285	—	10·22	34·94	26·89	1·10	—	0·00	11·8	4·20					
		380	—	9·13	34·81	26·97	1·20	24·27	0·00	14·9	4·06					
		570^1	573	7·49	34·74	27·17	2·07	26·41	—	28·1	3·02					
		760^1	—	6·40	34·76	27·33	2·43	33·55	—	40·8	2·36					
		950^1	955	5·64	34·80	27·47	2·55	32·84	—	46·3	2·16					
		1430^1	—	3·95	34·80	27·66	2·64	32·84	—	60·1	2·45					
		1900^1	1893	2·73	34·78	27·76	2·15	—	—	59·0	3·45					
1576	22	—	—	—	—	—	—	—	—	—	—	**N 70 B** **TYFB**	400–0	**2057**	**2151**	Estimated depth
												N 70 H	0–5	**2057**	**2157**	
												TYFB	1100–400	**2057**	**2219**	DGP
												N 70 B	1100–0	**2057**	**2256**	

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1577	13° 17·1′ S, 42° 35·2′ E	1935 26 iv	0630	3261*	S	13	S	3	bc	1016·7	28·1	24·4	low S swell
1578	11° 25·2′ S, 42° 03·1′ E	26–27 iv	2000 0000	2469* —	S S	17 17	S S	4 4	bc crq	1016·0 1014·7	26·7 27·2	24·5 23·9	heavy S swell heavy S swell
1579	09° 07·6′ S, 41° 28·4′ E	27 iv	1400	2838*	S	17	S	5	bcrq	1011·3	26·9	24·4	mod. S swell
1580	08° 44·6′ S, 41° 50·3′ E	27 iv	2000	3641*	SSE	18	SSE	5	cp	1013·2	26·1	23·9	mod. conf. S swell
1581	07° 42·1′ S, 44° 14·1′ E	28 iv	1815	4016*	SE × S	10	SE × S	3	crp	1012·0	27·2	25·0	low SE swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. ° C.	S ‰	σt	Mg.—atom $m.^3$				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1577	23	0	—	27·98	34·91	22·36	0·00	—	0·00	<4·2	4·35	**N 70 V**	50–0	0640		
		10	—	27·98	34·91	22·36	0·00	—	0·00	<4·2	—	,,	100–50			
		20	—	27·93	34·91	22·38	0·00	—	0·00	<4·2	4·37	,,	250–100			
		30	—	27·58	34·91	22·49	0·00	—	0·00	<4·2	—	,,	500–250	—	0720	
		40	—	26·78	35·09	22·88	0·00	—	0·00	<4·2	4·57	**NHP**	100–0	0854	0902	
		50	—	25·68	35·15	23·27	0·00	—	0·00	<4·2						
		60	—	24·68	35·09	23·53	0·10	—	0·06	<4·2	4·48					
		80	—	23·23	35·17	24·02	0·19	—	0·25	4·9						
		95	—	22·31	35·20	24·30	0·29	—	0·17	4·9	3·97					
		140	—	19·58	35·26	25·09	0·51	—	0·10	5·0	3·37					
		190	—	17·13	35·25	25·69	0·84	—	0·05	10·5	2·93					
		280	—	14·28	35·18	26·29	1·01	—	0·00	13·9	3·26					
		375	—	12·09	35·09	26·66	0·89	—	0·00	16·2	3·70					
		560^1	563	9·08	34·85	27·00	1·22	—	—	19·9	3·74					
		750^1	745	7·33	34·77	27·21	2·01	—	—	35·6	2·88					
		940^1	—	6·04	34·81	27·42	2·38	—	—	51·0	2·20					
		1410^1	1431	3·80	34·80	27·67	2·40	—	—	61·2	2·55					
		1910^2	1887	2·79	34·78	27·75	2·19	—	—	73·3	2·95					
		2380^2	—	2·32	34·77	27·78	1·94	—	—	73·1	3·58					
		2860^2	2876	1·80	34·76	27·81	2·24	—	—	74·9	3·48					
1578	23	0	—	28·18	34·88	22·26	0·00	—	0·00	<4·2	4·37	**N 70 B**	500–0	**2102**	**2154**	DGP
		10	—	28·18	34·90	22·28	0·00	—	0·00	<4·2	—	**TYFB**				
		20	—	28·18	34·90	22·28	0·00	—	0·00	<4·2	4·37	**TYFB**	1000–550	**2102**	**2223**	DGP
		30	—	28·18	34·90	22·28	0·00	—	0·00	<4·2	—	**N 70 B**	1000–0	**2102**	**2300**	
		40	—	28·18	34·90	22·28	0·00	—	0·00	<4·2	4·36	**NHP**	100–0	**2321**	**2327**	
		50	—	27·08	34·94	22·67	0·00	—	0·00	<4·2	—	**N 70 V**	50–0	**2329**		
		60	—	26·48	35·00	22·91	0·00	—	0·00	<4·2	4·60	,,	100–50			
		80	—	24·08	35·16	23·75	0·15	—	0·00	4·8	—	,,	250–100			
		100	—	21·67	35·21	24·49	0·46	—	0·06	6·4	3·62	,,	500–250	—	**2359**	
		150	—	17·67	35·29	25·59	0·72	—	0·11	11·3	3·09					
		195	—	16·02	35·30	25·99	0·80	—	0·00	12·2	3·16					
		295	—	13·48	35·18	26·46	1·12	—	0·00	15·3	3·23					
		390	—	11·54	35·07	26·74	1·12	—	0·00	10·3	3·83					
		590^1	586	8·51	34·77	27·03	1·67	—	—	20·3	3·39					
		780^1	—	6·64	34·73	27·28	2·32	—	—	36·4	2·69					
		980^1	979	6·20	34·81	27·40	2·64	—	—	38·5	2·07					
		1460^1	—	4·02	34·80	27·65	2·70	—	—	55·5	2·48					
		1950^1	1945	2·76	34·78	27·75	2·47	—	—	66·6	3·22					
1579	24	0	—	27·78	34·83	22·36	0·00	1·43	0·00	<4·2	4·39	**N 70 V**	50–0	1412		
		10	—	27·78	34·84	22·37	0·00	—	0·00	<4·2	—	,,	100–50			
		20	—	27·78	34·84	22·37	0·00	2·14	0·00	<4·2	4·40	,,	250–100			
		30	—	27·78	34·84	22·37	0·00	—	0·00	<4·2	—	,,	500–250			
		40	—	27·78	34·84	22·37	0·00	2·86	0·00	<4·2	4·37	**NHP**	100–0	—	1452	
		50	—	27·42	34·91	22·54	0·00	—	0·00	<4·2						
		60	—	24·68	35·17	23·59	0·00	0·71	0·06	<4·2	4·65					
		80	—	22·04	35·24	24·41	0·36	2·86	0·00	5·0						
		100	—	21·02	35·25	24·69	0·38	3·57	0·00	6·2	3·78					
		145	—	17·92	35·34	25·57	0·65	8·57	0·00	10·5	3·21					
		195	—	14·91	35·20	26·17	0·84	12·85	0·00	11·6	3·13					
		290	—	12·13	35·08	26·64	1·18	—	0·00	13·6	3·29					
		390	—	10·54	34·93	26·82	1·18	16·42	0·00	13·6	4·18					
		580^1	582	8·34	34·77	27·06	2·30	22·84	—	24·8	2·79					
		780^1	—	7·61	34·87	27·25	2·64	28·56	—	36·8	1·93					
		910^2	867?	7·46	34·90	27·30	2·72	34·27	—	39·3	1·47					
		1370^2	1362	4·59	34·81	27·60	2·72	34·27	—	50·0	2·15					
		1820^2	—	3·18	34·75	27·70	2·72	—	—	58·4	2·75					
		2280^2	2282	2·41	34·75	27·76	2·51	34·27	—	66·7	3·18					
1580	24	—	—	—	—	—	—	—	—	—	—	**N 70 B**	450–0	**2115**	**2207**	DGP
												TYFB	450–0	**2115**	**2220**	
												TYFB	1300–750	**2115**	**2240**	DGP
												N 70 B	1300–0	**2115**	**2330**	
1581	25	0	—	28·88	34·88	22·03	0·00	0·00	0·00	<4·2	4·34	**N 50 V**	100–0	**1935**		
		10	—	28·83	34·89	22·06	0·00	—	0·00	<4·2	—	**N 70 V**	50–0			

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1581 *cont.*	07° 42·1′ S, 44° 14·1′ E	1935 28 iv											
1582	05° 39·1′ S, 46° 22·3′ E	29 iv	2000	4565*	SE × E	9	SE × E	2	bc	1012·1	28·3	25·6	low SE swell
1583	04° 25·9′ S, 47° 10′ E	30 iv	0930	4737*	SE × E	9	SE × E	2	b	1012·0	28·9	22·5	low SE swell
1584	00° 57·8′ S, 49° 26·7′ E	1 v	1230	4963*	SE × E	6	SE × E	2	bc	1010·4	29·4	25·0	low SE × E swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
							Mg.—atom m.³							TIME		
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	P	Nitrate + Nitrite N_2	Nitrite N_2	Si	O_2 c.c. litre	Gear	Depth (metres)	From	To	
1581 *cont.*	25	20	—	28·48	34·94	22·21	0·00	0·00	0·00	<4·2	4·42	**N 70 V**	100–50			
		30	—	25·88	35·18	23·24	0·00	—	0·00	<4·2	—	,,	250–100			
		40	—	23·33	35·23	24·03	0·00	0·00	0·00	<4·2	4·55	,,	500–250			
		50	—	22·29	35·26	24·36	0·21	—	0·11	<4·2	—	**NHP**	100–0	—	**2018**	
		60	—	21·10	35·27	24·70	0·30	2·14	0·37	4·9	3·85	**N 70 B**	600–0	**2138**	**2230**	DGP
		80	—	18·90	35·29	25·29	0·57	9·99	0·21	9·2	—	**TYFB**				
		100	—	17·21	35·30	25·72	0·70	11·42	0·00	12·0	3·04	**N 70 H**	0–5	**2138**	**2238**	
		150	—	14·91	35·32	26·25	0·76	10·71	0·00	13·1	3·47	**TYFB**	1750–600	**2138**	**2303**	DGP
		200	—	12·51	35·15	26·63	1·03	12·14	0·00	13·8	3·77	**N 70 B**	1750–0	**2138**	**2345**	
		300	—	10·87	34·99	26·81	1·20	—	0·00	13·5	3·78					
		400	—	9·89	34·90	26·92	1·35	22·84	0·00	18·0	3·46					
		600[1]	599	7·68	34·77	27·16	2·28	29·27	—	29·1	2·54					
		800[1]	—	7·30	34·90	27·32	2·89	37·12	—	47·8	1·61					
		1000[1]	998	6·15	34·88	27·46	2·91	39·26	—	51·1	1·69					
		1470[2]	1460	3·76	34·77	27·65	2·85	37·84	—	55·3	2·40					
		1960[2]	—	2·61	34·75	27·75	2·62	—	—	63·1	3·04					
		2450[2]	2461	2·13	34·74	27·78	2·36	37·84	—	68·7	3·17					
		2940[2]	—	1·93	34·73	27·78	2·28	—	—	75·1	3·31					
		3430[2]	3421	1·64	34·73	27·81	2·36	37·84	—	78·1	3·49					
1582	26	—	—	—	—	—	—	—	—	—	—	**N 450 H** **N 70 H**	1900–1850(–0)	**2119**	**2249**	DGP. Nets reached surface at **2351**
1583	27	0	—	29·53	35·32	22·14	0·00	0·71	0·00	<4·2	4·30	**N 50 V**	100–0	0941		
		10	—	29·38	35·32	22·19	0·00	—	0·00	<4·2	—	**N 70 V**	50–0			
		20	—	28·78	35·34	22·41	0·00	0·71	0·00	<4·2	4·44	,,	100–50			
		30	—	28·13	35·36	22·65	0·00	—	0·00	<4·2	—	,,	250–100			
		40	—	27·78	35·36	22·76	0·00	0·71	0·00	<4·2	4·51	,,	500–250	—	1023	
		50	—	27·18	35·37	22·96	0·00	—	0·00	<4·2						
		60	—	26·83	35·37	23·08	0·00	2·14	0·00	4·8	4·52					
		80	—	23·88	35·31	23·94	0·23	21·42	0·28	7·0						
		100	—	20·67	35·28	24·81	0·46	6·43	0·07	11·9	3·26					
		150	—	13·90	35·17	26·36	1·12	14·28	0·00	14·9	2·72					
		200	—	12·61	35·13	26·59	1·06	14·28	0·00	15·5	3·40					
		300	—	10·67	34·99	26·85	1·20	—	0·00	16·1	3·66					
		400	—	9·53	34·90	26·98	1·60	26·41	0·00	24·0	2·87					
		590[1]	594	7·81	34·80	27·17	2·41	31·41	—	36·8	1·90					
		790[1]	—	6·86	34·89	27·37	2·62	40·69	—	45·8	1·45					
		990[1]	1004?	6·43	34·96	27·48	2·72	44·98	—	49·8	1·35					
		1480[1]	—	3·90	34·79	27·65	2·64	39·26	—	70·0	2·41					
		1980[1]	1976	2·55	34·78	27·77	2·55	—	—	70·9	3·04					
		2470[2]	2386?	2·04	34·76	27·80	2·49	40·69	—	75·6	3·18					
		2960[2]	—	1·74	34·74	27·81	2·30	—	—	75·9	3·41					
		3460[2]	3438	1·62	34·73	27·81	2·19	40·69	—	75·4	3·51					
		3950[2]	—	1·46	34·72	27·81	2·43	—	—	73·7	3·66					
		4440[2]	4462	1·25	34·72	27·82	2·43	—	—	73·9	3·80					
1584	28	0	—	29·68	35·45	22·19	0·00	0·71	0·00	<4·2	4·32	**N 50 V**	100–0	1237		
		10	—	29·28	35·45	22·33	0·00	—	0·00	<4·2	—	**N 70 V**	50–0			
		20	—	29·18	35·45	22·36	0·00	0·71	0·00	<4·2	4·34	,,	100–50			
		30	—	26·98	35·45	23·08	0·00	—	0·00	<4·2	—	,,	250–100			
		40	—	26·58	35·49	23·24	0·00	0·71	0·00	<4·2	4·42	,,	500–250	—	1326	
		50	—	26·48	35·49	23·27	0·00	—	0·00	<4·2						
		60	—	26·38	35·49	23·30	0·00	0·71	0·00	4·8	4·38					
		80	—	23·98	35·43	23·99	0·25	3·57	0·26	7·7						
		100	—	21·42	35·29	24·62	0·42	9·99	0·10	8·8	3·29					
		150	—	13·60	35·20	26·44	1·06	2·14	0·00	16·1	2·63					
		200	—	12·91	35·11	26·52	1·10	37·84	0·00	16·3	3·11					
		300	—	10·92	35·00	26·81	1·41	—	0·00	17·7	2·76					
		400	—	10·14	34·99	26·94	1·44	27·13	0·00	23·8	2·37					
		590[1]	616?	8·96	34·97	27·13	2·24	38·55	—	31·5	1·58					
		790[1]	—	7·78	34·98	27·32	2·66	43·55	—	43·4	1·23					
		990[1]	1001	7·01	34·96	27·40	2·62	44·98	—	46·3	1·48					
		1490[1]	—	4·36	34·82	27·63	2·59	45·69	—	58·4	2·07					
		1980[1]	1972	2·87	34·78	27·74	2·66	—	—	65·6	2·60					
		2470[2]	2400?	2·19	34·75	27·78	2·45	45·69	—	71·2	2·83					
		2960[2]	—	1·85	34·74	27·80	2·11	—	—	72·2	3·26					

Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1584 *cont.*	00° 57·8′ S, 49° 26·7′ E	1935 1 v											
1585	00° 06′ S, 49° 45·4′ E	1 v	2000	5046*	SE × E	5	SE	2	b	1011·1	28·3	25·0	low SE swell
1586	02° 39·4′ N, 50° 46·4′ E	2 v	1700	4737*	—	0	—	1	b	1010·0	28·3	25·0	low swell
1587	06° 05′ N, 52° 00′ E	3 v	2000	5098*	NNE	12	NNE	2–3	or	1011·6	24·4	24·4	low NNE swell
1588	07° 08·6′ N, 52° 19·3′ E	4 v	0520	5074*	E × S	8	E × S	3	c	1011·9	27·1	23·9	low conf. E swell
1589	11° 32·3′ N, 52° 03′ E	5 v	1100	1083*	Lt airs	0–1	—	0–1	b	1011·2	30·6	25·7	indeterminate swell

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.^{3}				O_2 c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N_2	Nitrite N_2	Si				From	To	
1584 *cont.*	28	3450[2]	—	1·65	34·74	27·82	2·11	45·69	—	73·1	3·45					
		3950[2]	—	1·47	34·74	27·83	2·28	—	—	74·2	3·60					
		4440[2]	4442	1·34	34·73	27·83	—	—	—	75·1	3·80					
1585	28	—	—	—	—	—	—	—	—	—	—	**N 70 B**	500–0	**2119**	**2215**	DGP
												TYFB				
												N 70 H	0–5	**2119**	**2224**	
												TYFB	1400–700	**2119**	**2243**	DGP
												N 70 B	1400–0	**2119**	**2325**	
1586	29	0	—	30·48	35·37	21·86	0·00	14·28	0·00	<4·2	4·31	**N 50 V**	100–0	1708		
		10	—	29·98	35·37	22·03	0·00	—	0·00	<4·2	—	**N 70 V**	50–0			
		20	—	29·88	35·37	22·07	0·00	12·14	0·00	<4·2	4·33	,,	100–50			
		30	—	29·78	35·37	22·10	0·00	—	0·00	<4·2	—	,,	250–100			
		40	—	29·28	35·34	22·24	0·00	12·85	0·00	<4·2	4·40	,,	500–250	—	**1745**	
		50	—	29·18	35·31	22·26	0·00	—	0·00	<4·2	—	**N 70 H**	0–5	**2100**	**2145**	
		60	—	27·33	35·64	23·11	0·00	12·14	0·00	<4·2	4·23	**N 70 B**	550–0	**2100**	**2150**	DGP
		80	—	26·13	35·64	23·49	0·27	12·85	0·09	4·9	—	**TYFB**				
		100	—	23·60	35·63	24·26	0·78	26·41	0·31	6·7	2·91	**TYFB**	1650–950	**2100**	**2217**	DGP
		150	—	17·37	35·45	25·79	1·35	29·27	0·00	14·7	1·88	**N 70 B**	1650–0	**2100**	**2302**	
		200	—	13·56	35·25	26·48	1·41	30·70	0·00	15·6	2·02					
		300	—	11·63	35·15	26·80	1·79	—	0·00	18·7	2·01					
		400	—	10·84	35·05	26·86	1·81	32·84	0·00	20·1	2·34					
		600[1]	598	9·67	35·21	27·19	2·93	38·55	—	31·3	0·82					
		800[1]	—	8·17	35·15	27·39	3·06	42·83	—	40·0	0·73					
		1000[1]	1004	6·94	35·10	27·53	3·06	48·55	—	46·3	0·93					
		1500[1]	—	4·25	34·90	27·71	2·66	48·55	—	59·9	1·94					
		2000[1]	1994	2·71	34·79	27·77	2·45	—	—	64·4	2·78					
		2460[2]	2440	2·16	34·76	27·79	2·22	45·69	—	67·3	2·99					
		2950[2]	—	1·83	34·75	27·81	2·22	—	—	69·4	3·23					
		3450[2]	3456	1·62	34·74	27·82	1·98	45·69	—	69·2	3·43					
		3940[2]	—	1·48	34·74	27·83	2·28	—	—	70·2	3·62					
		4430[2]	4426	1·32	34·73	27·83	2·40	—	—	70·2	3·60					
1587	1	—	—	—	—	—	—	—	—	—	—	**N 70 B**	450–0	**2108**	**2158**	DGP
												TYFB				
												TYFB	1250–800	**2108**	**2225**	DGP
												N 70 B	1250–0	**2108**	**2305**	
1588	2	0	—	29·58	35·53	22·29	0·00	7·85	0·00	<4·2	4·35	**N 70 V**	50–0	0534		
		10	—	29·58	35·54	22·30	0·00	—	0·00	<4·2	—	,,	100–50			
		20	—	29·58	35·52	22·27	0·00	7·14	0·00	<4·2	4·34	,,	250–100			
		30	—	29·38	35·52	22·34	0·00	—	0·00	<4·2	—	,,	500–200	—	0630	
		40	—	28·98	35·54	22·51	0·00	8·57	0·00	<4·2	4·47					
		50	—	27·68	35·48	22·88	0·00	—	0·00	<4·2						
		60	—	27·38	35·49	22·98	0·00	8·57	0·00	<4·2	4·59					
		80	—	26·78	35·56	23·23	0·00	9·99	0·00	4·7						
		100	—	25·25	35·66	23·78	0·29	9·28	0·39	4·9	3·94					
		150	—	21·03	35·52	24·89	1·20	18·56	0·00	11·3	1·92					
		200	—	15·82	35·38	26·11	2·07	27·84	0·00	16·1	1·12					
		300	—	12·58	35·31	26·74	2·26	—	0·00	17·4	1·32					
		400	—	11·64	35·39	26·98	2·60	29·98	0·00	26·1	0·65					
		590	—	9·84	35·27	27·21	2·62	31·41	—	29·3	0·97					
		790[1]	792	8·69	35·22	27·37	3·06	35·70	—	40·1	0·63					
		990[1]	—	7·53	35·19	27·51	3·06	37·84	—	48·2	0·89					
		1490[1]	1490	4·92	35·01	27·72	3·02	37·12	—	57·8	1·47					
		1980[1]	—	3·04	34·83	27·77	2·95	—	—	75·0	2·17					
		2480[1]	2472	2·09	34·78	27·81	2·72	37·12	—	75·0	2·98					
		2910[2]	2894	1·89	34·75	27·81	2·17	—	—	76·0	3·07					
		3390[2]	—	1·66	34·74	27·81	2·38	37·12	—	75·2	3·34					
		3880[2]	3866	1·52	34·73	27·82	1·84	—	—	74·7	3·60					
		4360[2]	—	1·39	34·73	27·82	1·94	—	—	75·2	3·82					
		4850[2]	4889	1·35	34·73	27·83	2·49	—	—	79·1	3·61					
1589	3	0	—	29·78	35·50	22·20	0·00	12·85	0·00	<4·2	4·32	**N 70 B**	600–0	1132	1232	DGP
		10	—	29·23	35·54	22·42	0·00	—	0·00	<4·2	—	**TYFB**				
		20	—	29·18	35·98	22·76	0·00	12·85	0·00	<4·2	4·37	**N 50 V**	100–0	1245		

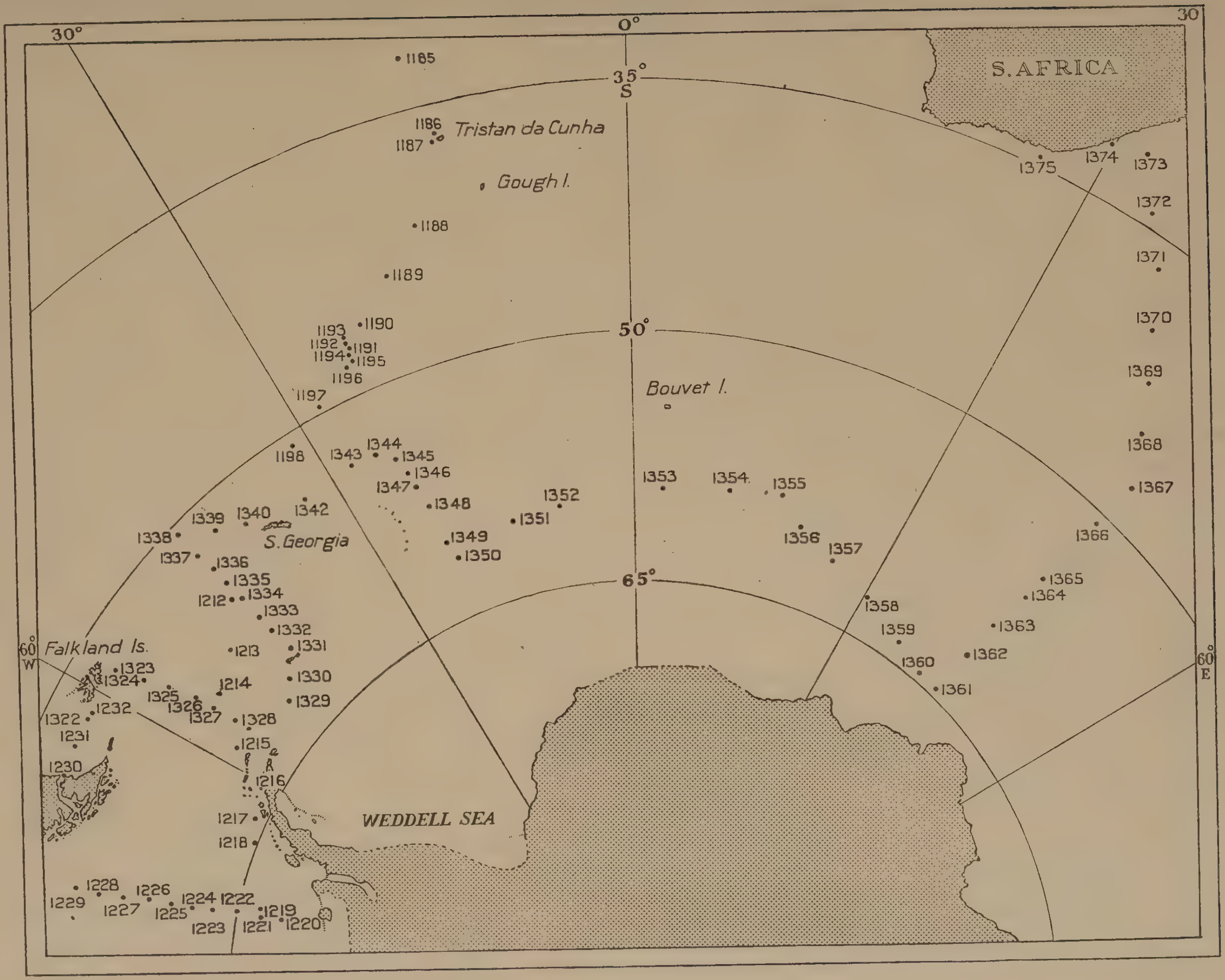
Station	Position	Date	Hour	Sounding (metres)	WIND		SEA		Weather	Barometer (millibars)	Air Temp. ° C.		Remarks
					Direction	Force (knots)	Direction	Force			Dry bulb	Wet bulb	
1589 *cont.*	11° 32·3′ N, 52° 03′ E	1935 5 v											

Station	Age of moon (days)	HYDROLOGICAL OBSERVATIONS										BIOLOGICAL OBSERVATIONS				Remarks
		Depth (metres)	Depth by thermometer	Temp. °C.	S ‰	σt	Mg.—atom m.^{3}				O$_2$ c.c. litre	Gear	Depth (metres)	TIME		
							P	Nitrate + Nitrite N$_2$	Nitrite N$_2$	Si				From	To	
1589 *cont.*	3	30	—	28·98	36·07	22·90	0·00	—	0·00	<4·2	—	**N 70 V**	50–0			
		40	—	26·68	35·64	23·32	0·00	12·85	0·00	<4·2	4·57	,,	100–50			
		50	—	26·58	35·92	23·57	0·00	—	0·00	<4·2	—	,,	250–100			
		60	—	26·38	36·03	23·71	0·00	12·85	0·00	<4·2	4·64	,,	500–250	—	1321	
		80	—	25·78	36·16	24·00	0·00	12·85	<0·04	<4·2						
		95	—	25·30	36·16	24·14	0·00	12·85	0·53	<4·2	4·23					
		140	—	20·63	35·69	25·13	1·39	12·85	0·00	8·6	1·36					
		190	—	16·47	35·39	25·96	1·96	32·84	0·00	17·8	0·81					
		285^1	273	14·52	35·54	26·52	2·43	—	0·00	18·8	0·46					
		380^1	—	12·44	35·40	26·83	2·47	35·70	0·00	21·0	0·61					
		570^1	580	12·91	36·06	27·25	2·60	33·55	—	28·1	0·54					
		760^1	—	11·59	35·85	27·34	2·79	35·70	—	31·1	0·39					
		940^1	927	9·67	35·60	27·49	2·89	44·98	—	43·2	0·53					

SUMMARIZED LIST OF STATIONS

The positions of all stations made by the R.R.S. 'Discovery II' between November 1933 and May 1935 are shown on the charts reproduced in Plates I–IV B. The following list indicates on which chart each of the stations is to be found.

Station	Date	Place	Plate
1185–1187	14. xi.–18. xi. 33	Tristan da Cunha	I
1188–1198	19. xi.–25. xi. 33	Tristan da Cunha to South Georgia	I
1199–1211	26. xi.–4. xii. 33	South Georgia	IV A
1212–1220	5. xii.–13. xii. 33	South Georgia to ice-edge in 80° W	I
1220–1229	13. xii.–18. xii. 33	1st line in 80° W	I
1230–1232	23. xii.–24. xii. 33	Eastern side Magellan Strait to Falkland Islands	I
1233–1238	28. xii. 33–2. i. 34	Falkland Islands to ice-edge in 80° W	II A
1238–1267	2. i.–16. i. 34	Westward ice-edge cruise in South Pacific Ocean	II A
1267–1281	16. i.–28. i. 34	Ice-edge north of Ross Sea to New Zealand	II A
1282–1312	20. ii.–10. iii. 34	Eastward ice-edge cruise in South Pacific Ocean	II B
1312–1320	10. iii.–14. iii. 34	2nd line in 80° W	II B
1321	16. iii. 34	Entrance to Cockburn Channel	II B
1322–1340	21. iii.–9. iv. 34	Scotia Sea	I
1341	20. iv. 34	South Georgia	IV A
1342–1375	21. iv.–25. v. 34	South Georgia to Cape Town via South Sandwich Islands, ice-edge off Enderby Land and Durban	I
1376–1393	2. viii.–24. viii. 34	South Africa to South Georgia	III
1394–1406	25. viii.–3. ix. 34	South Georgia	IV A
1407–1415	4. ix.–12. ix. 34	South Georgia to ice-edge in 80° W	III
1415–1421	12. ix.–15. ix. 34	3rd line in 80° W	III
1422–1440	20. ix.–12. x. 34	Scotia Sea	III
1441–1450	26. x.–30. x. 34	4th line in 80° W	IV B
1451–1472	31. x.–14. xi. 34	Ice-edge cruise north of Bellingshausen Sea	IV B
1472–1476	14. xi.–17. xi. 34	5th line in 80° W	IV B
1477–1478	4. xii.–5. xii. 34	Drake Strait	III
1479–1490	13. xii. 34–20. i. 35	Shore Collecting Stations, Bransfield Strait area, etc.	III (inset)
1491–1495	23. i.–25. i. 35	Scotia Sea	III
1496–1508	26. i.–8. ii. 35	South Georgia	IV A
1509–1543	9. ii.–27. ii. 35	South Georgia to ice-edge off Enderby Land	III
1543–1553	27. ii.–7. iii. 35	Ice-edge off Enderby Land to north of Antarctic Convergence in 30° E	III
1554–1569	28. iii.–12. iv. 35	Cape Town to Durban via Marion and Prince Edward Islands	III
1570–1589	21. iv.–5. v. 35	Cruise up east coast of Africa	III (inset)


30°
0°
30
35° S
50°
65°
60° W
60° E
S. AFRICA
Tristan da Cunha
Gough I.
Bouvet I.
S. Georgia
Falkland Is.
WEDDELL SEA
1185
1186
1187
1188
1189
1190
1191
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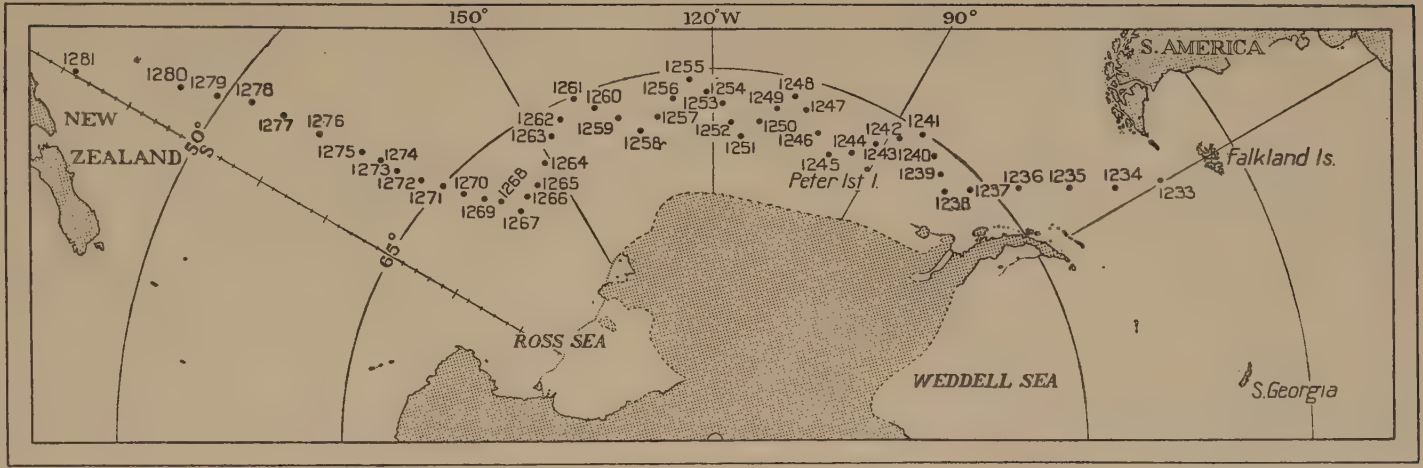
150°
120°W
90°
NEW ZEALAND
50°
65°
S. AMERICA
Falkland Is.
S. Georgia
ROSS SEA
WEDDELL SEA
Peter Ist I.
1233
1234
1235
1236
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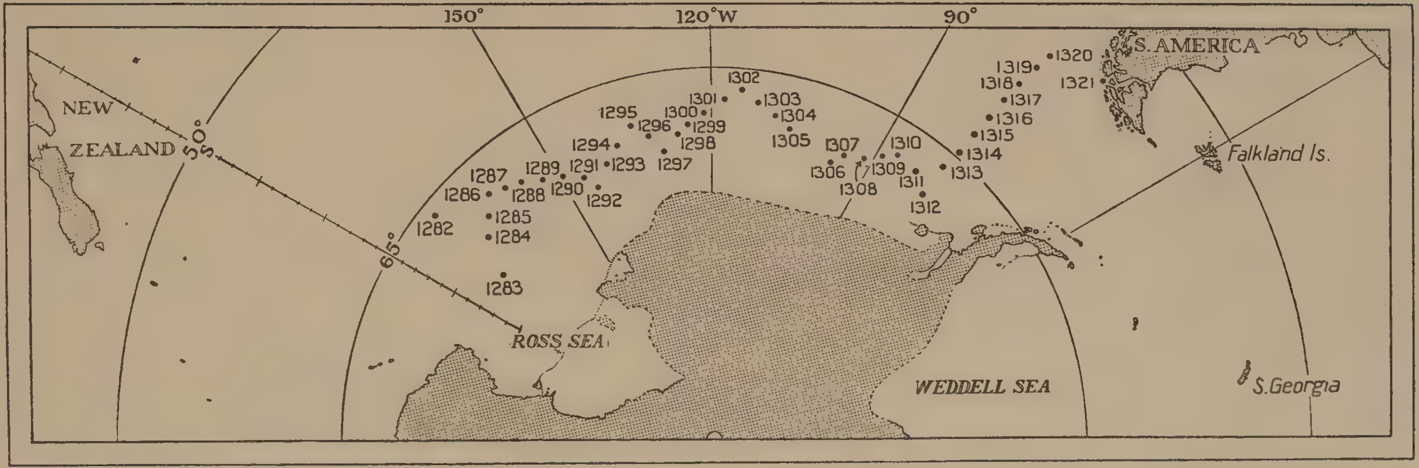
A


150°
120°W
90°
NEW ZEALAND
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65°
S. AMERICA
Falkland Is.
S. Georgia
ROSS SEA
WEDDELL SEA
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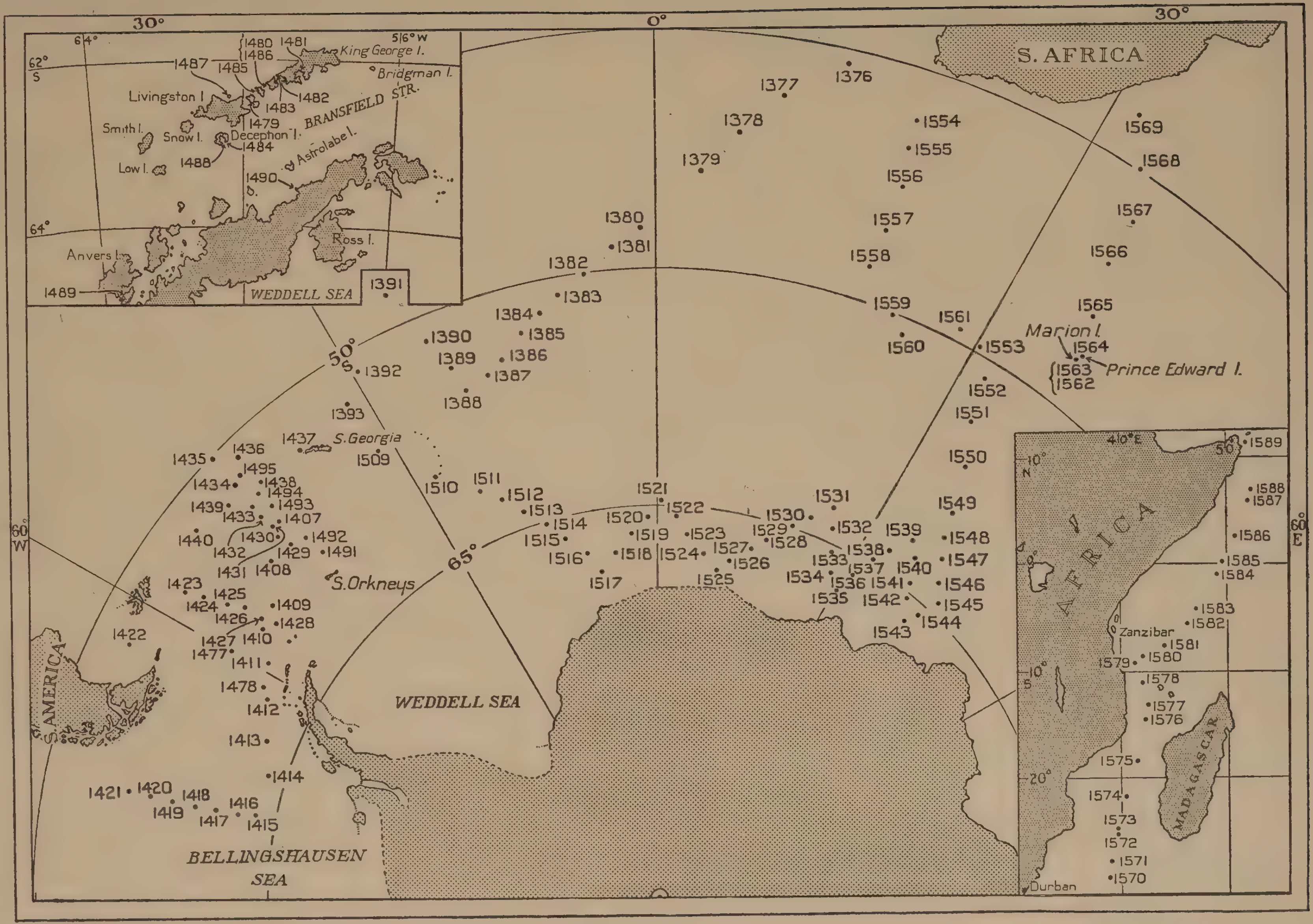
30°
0°
30°
S. AFRICA
64°
516° W
62° S
1480
1486
1481
King George I.
Bridgman I.
1487
1485
1483
1482
Livingston I
1479
BRANSFIELD STR.
Smith I.
Snow I.
Deception I.
1484
Astrolabe I.
1488
Low I.
1490
64°
Ross I.
Anvers I.
1489
WEDDELL SEA
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1387
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1389
1390
1392
1393
50° S
1554
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1556
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1561
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1550
1549
1569
1568
1567
1566
1565
Marion I.
1564
1563
1562
Prince Edward I.
1437
S. Georgia
1509
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1492
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1432
1429
1491
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1408
S. Orkneys
1423
1425
1424
1409
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1410
1477
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1478
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1414
1421
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1417
1416
1415
BELLINGSHAUSEN SEA
S. AMERICA
60° W
1510
1511
1512
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1516
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65°
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1548
WEDDELL SEA
40° E
50
10° N
1589
1588
1587
60° E
1586
1585
1584
AFRICA
1583
1582
Zanzibar
1581
1579
1580
10° S
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MADAGASCAR
1575
20°
1574
1573
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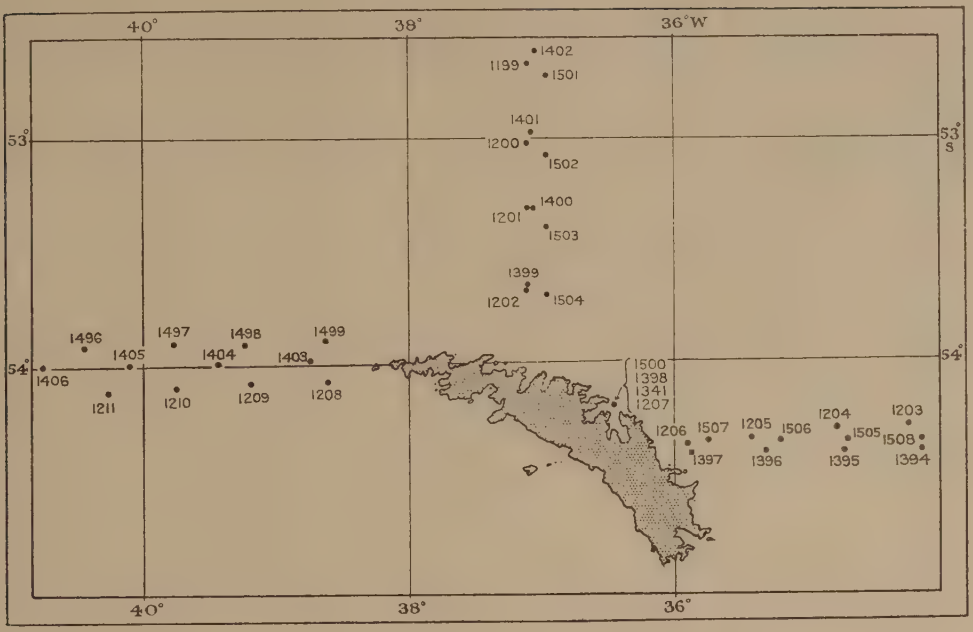
1571
1570
Durban


40°
38°
36°W
53°
53° S
54°
54°
1402
1199
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1200
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1201
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1399
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1504
1496
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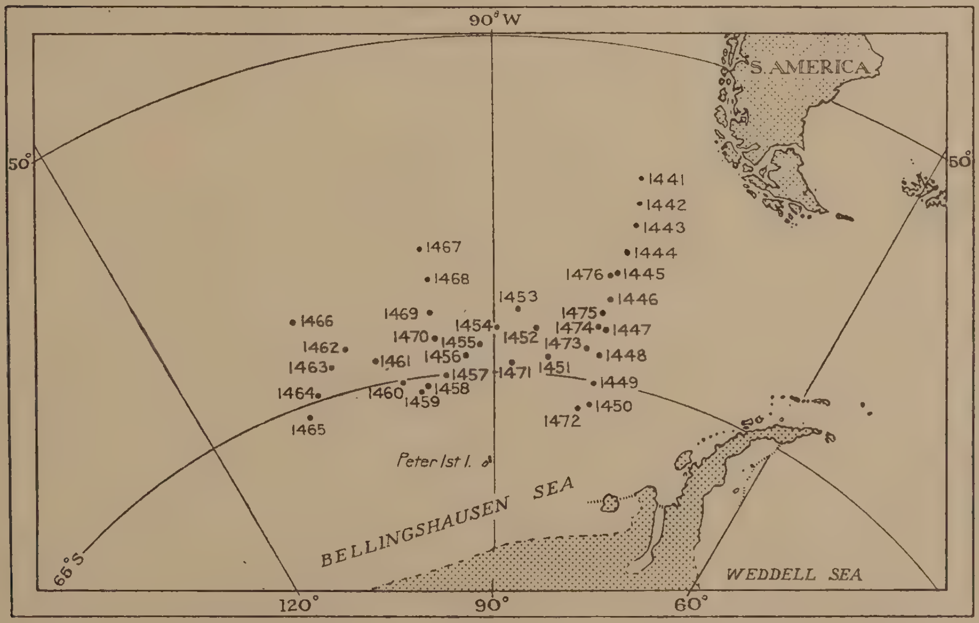
A


90°W
S. AMERICA
50°
50°
1441
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1471
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1460
1459
1458
1450
1472
1465
Peter Ist I.
BELLINGSHAUSEN SEA
WEDDELL SEA
66°S
120°
90°
60°

B

[*Discovery Reports. Vol. XXII, pp.* 197–300, *June* 1942]

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THE SOUTHERN STOCKS OF WHALEBONE WHALES

By

N. A. MACKINTOSH, D.Sc.

CONTENTS

Introduction . . . . page 199

Species of whalebone whales 201
  External characters and specific identity 201
  Size range 204
  Weight 205
  Yield of oil 208

Food in the Antarctic and in warmer waters 209

Parasites and diseases 213

Breeding, growth and age 216
  The mean length at sexual maturity 216
  The reproductive organs 219
  Persistence of the corpora lutea of the ovaries 220
  Breeding 221
  Growth to sexual maturity 224
  The determination of age 225

Statistics of catches 227
  Southern whaling centres 228

Migrations and distribution 236
  Humpbacks 237
  Blue and Fin whales 249

Relative abundance of the different species 260

Sex ratio 266

Seasonal changes in the local composition of the stock 269
  The monthly species ratio 270
  The monthly sex ratio 272
  Monthly average lengths and percentage of immature whales 274
  The monthly percentage of pregnant females 277

The stock of whales 278
  Evidence of the depletion of the stock 278
  Relative depletion of the different species 281
  Prospects of estimating the absolute magnitude of the stock 282
  The effect on the stock of whaling at different times and in different places 284
    Species and classes of whales 285
    Whaling in different regions 286
    Whaling in different months 291
    A note on sanctuaries 292
  The reduction of whaling during the war 293

Summary 293

Appendix. Common names of whalebone whales 297

References 298

THE SOUTHERN STOCKS OF WHALEBONE WHALES

By N. A. Mackintosh, D.Sc.

(Text-figs. 1–9)

INTRODUCTION

THE Discovery Committee's investigations in recent years on whales in the Southern Ocean may be considered to fall roughly into two categories. In the first place, arrangements were made for direct observations on whales by research at whaling stations, by whale marking, by records of whales seen during voyages of the Committee's ships, and by the collection of additional data from miscellaneous sources. These are the type of observations which can to a large extent be treated separately, and which quickly lead to information of practical value on the general biology of whales. In the second place, a programme of oceanographical research on very broad lines has been conducted in the Southern Ocean. This is a long-range investigation designed to elucidate the factors in the environment of whales which control their distribution and movements, and at the same time to build up a framework of knowledge of the general hydrology and interrelations of the fauna and flora of the Southern Ocean. This work at sea, the greater part of it carried out by the R.R.S. 'Discovery II', has continued for years almost without interruption, and it was impossible for the analysis of the data and preparation of reports to keep pace with the rapid accumulation of material so long as work in the field was in progress. Although good progress has been made with the treatment of this material, some years would yet be needed for the full co-ordination of the results, and the work has of course been interrupted since the outbreak of war.

The direct work on whales, however, has reached a stage at which the results can be treated comprehensively, and it is the purpose of this paper to summarize work which has already been published, to present conclusions reached from additional material, to correlate the results with statistics of the whaling industry, and to discuss the practical implications of our knowledge of the stock of whales. This is by no means a final analysis of the more direct data on whales, for it is not yet possible to complete some work on the growth and age of whales (see p. 216), and the recovery of more whale marks should provide further information on migrations.

Among papers already published in the *Discovery Reports* frequent reference must be made to Mackintosh and Wheeler (1929), Matthews (1937, 1938*c*) and Rayner (1940); and many others contain material for consideration. In the later part of this paper considerable use is made of the *International Whaling Statistics* published in Oslo by the Committee appointed by the Norwegian Government, and of the important series of papers by Hjort, Bergersen, Lie and Ruud on 'Pelagic Whaling in the Antarctic' published in *Hvalrådets Skrifter*. The latter authors, having access to the log books of factory ships, give certain particulars, such as the distribution and movements of the whaling fleet, which do not appear in the International Statistics, and carry the analysis of the data to a more advanced stage. Other papers cited are listed on p. 298.

The first paper mentioned above (1929) is a general report on the results of the earlier work at whaling stations, mainly at South Georgia, and it was prepared when, in 1927, 1683 whales (not all Blue and Fin whales) had been examined. Work at the whaling stations and in factory ships was continued for some years afterwards, and although subsequent papers by Wheeler and Matthews were partly based on the new material there are data on several thousand additional whales which have not hitherto been fully analysed. Particulars are given in Table 1. Besides the whales shown here, Mr Laurie, in the 'Southern Princess' in 1932–3, recorded particulars of 1698 Blue, 302 Fin, and 24 Humpback whales. These, however, are not listed in Table 1 because a considerable number of them were not examined, or only partially examined by himself. Other

Table 1. *Whales examined at shore stations and in factory ships*

Place	Season	Blue		Fin		Sei		Hump-back		Southern Right		Sperm		Total
		♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	
(*a*) At shore stations:														
South Georgia	1924–5	50	58	56	75	—	—	1	1	—	—	—	—	241
	1925–6	58	71	210	139	—	—	5	13	1	—	—	—	497
	1926–7	155	146	61	62	14	48	—	—	1	—	4	—	491
	1927–8	7	4	23	25	7	9	—	—	—	—	20	—	95
	1928–9	113	148	238	207	11	50	1	2	—	—	7	—	777
	1929–30	48	49	298	272	14	28	4	3	—	—	10	—	726
	1930–1	102	74	98	111	8	12	7	8	—	1	3	—	424
Total		533	550	984	891	54	147	18	27	2	1	44	—	3251
Durban	1926	1	2	7	4	1	—	4	—	—	—	2	—	21
	1930	26	32	26	26	6	2	7	3	—	—	20	13	161
Total		27	34	33	30	7	2	11	3	—	—	22	13	182
Saldanha Bay	1926	120	127	114	75	4	7	2	2	1	1	1	1	455
Total at shore stations		680	711	1131	996	65	156	31	32	3	2	67	14	3888
(*b*) In factory ships:														
'Salvestria'	1939–40	79	91	201	178	—	—	—	2	—	—	13	—	564
'Hektoria'	1939–40	36	47	201	175	—	—	—	—	—	—	—	—	459
'Svend Foyn'	1940–1	48	58	230	236	—	—	—	—	—	—	—	—	572
Total in factory ships		163	196	632	589	—	—	—	2	—	—	13	—	1595
Grand total		843	907	1763	1585	65	156	31	34	3	2	80	14	5483

members of the staff who have taken part from time to time in the collection of data at whaling stations are Dr F. C. Fraser, Dr J. E. Hamilton, Mr L. H. Matthews, Dr F. D. Ommanney, Mr G. W. Rayner, Mr A. Saunders, and Dr J. F. G. Wheeler. Dr Ommanney also worked in the 'Salvestria' in 1939–40, and Mr P. R. Crimp, who conducted similar work in the 'Hektoria' (1939–40) and the 'Svend Foyn' (1940–41), has generously placed his data at the disposal of the Discovery Committee. Mr Rayner's report on whale marking was written when 5219 whales were estimated to have been effectively marked and 203 marks had been recovered. Additional whale marks recovered since then are not yet sufficient for a new analysis of these data, but I have found the original records of the species and positions of whales marked to be of assistance in studying distribution and the relative abundance of the species. Other original material used in this paper includes records of whales observed at sea, mainly during the voyages of the 'Discovery II', and various observations which several of the Whaling Inspectors have been kind enough to make for the Discovery Committee.

I have to acknowledge my indebtedness to the colleagues mentioned above whose work, spread over several years, has provided so much of the available data. I am grateful also for the considerable body of notes made by the Inspectors. Acknowledgements are made in the text where I have drawn upon their observations, but this material is not yet exhausted. My thanks also are due to Mr Harold Paulsen, secretary of the Association of Whaling Companies, who took much trouble in compiling for me certain particulars of the southern whaling grounds, and finally to Dr Stanley Kemp, F.R.S., and Dr F. C. Fraser, who have kindly read through the typescript of this paper and made a number of most helpful suggestions.

SPECIES OF WHALEBONE WHALES

This paper is concerned with the principal baleen or whalebone whales of economic importance; that is to say the Blue, Fin and Humpback whales. Sei whales are referred to here and there, but they are of less importance and the data relating to this species are very limited. Sperm whales, although of some minor importance to the whaling industry, are not included. They have been adequately dealt with by Matthews (1938*a*), and no new material, such as that from recovered whale marks, has come to hand. Occasional mention is made of the Southern Right and Minke whales, and a complete list of the species of whalebone whales, with the various common names by which they are known, is given in the Appendix.

EXTERNAL CHARACTERS AND SPECIFIC IDENTITY

An account here of the external characters of the different species would merely be a repetition of descriptions which have already been published, but it is perhaps worth while to draw attention to the literature on the subject and the bearing of specific identity on questions concerning the stock of whales.

The external characters of southern Blue and Fin whales are fully described by

Mackintosh and Wheeler (1929), and of Humpbacks and Sei whales by Matthews (1937, 1938*c*). These descriptions were based principally on large numbers of whales examined at South Georgia and stations in South Africa, and details are given of the external proportions, colour, baleen, ventral grooves, and hairs; and the extent of individual variation is described so far as the data permit. The most useful description of the external characters of whalebone whales in the northern hemisphere is probably that of True (1904), whose monograph deals exhaustively with Fin, Blue and Humpback whales, and in rather less detail with the Minke (or Lesser Rorqual) and the Atlantic Right whale.

Among other works which may be consulted are the following:

Allen (1916): a large monograph on the nomenclature, external characters, skeleton and habits of the Right, Fin, Sei, Blue, Minke and Humpback whales, and their occurrence and hunting in New England waters.

Andrews (1908): a short paper on external characters and osteology of the Atlantic Right whale.

Andrews (1914): a monograph on the Grey whale.

Andrews (1916*a*): an exhaustive account of the distribution, habits, external characters and osteology of the Sei whale.

Collett (1886): a brief description of the Sei whale.

Japha (1911): an account of the distribution, structure, etc., of hairs in various species.

Lillie (1910): notes on external characters, etc., particularly of the Fin whale.

Lillie (1915): a paper which includes various notes on external characters of southern Humpbacks, with special regard to colour variations.

Liouville (1913) describes the colour and form of most southern species.

Lonneberg (1931): an account of the skeleton of Bryde's whale and its distinctive features.

Matthews (1938*b*) gives some notes on the Southern Right whale together with a number of photographs.

Olsen (1913): a general description of Bryde's whale.

Peters (1938), in a book on the German whaling industry, includes short descriptions of the characters and habits of each species.

Ridewood (1901): an account of the 'bonnet' of the Right whale.

Struthers (1889): an account of the dissection of a Humpback, dealing principally with the skeleton.

This list is no doubt incomplete but gives some indication of the principal contributions to the subject. The literature includes detailed descriptions of the colour and external anatomy of whales in both the northern and southern hemispheres, but very few observations have been made on the osteology of southern whales. On the other hand, records of the measurements of external proportions of northern whales are very scarce compared with the number available from southern whales, at any rate from Blue and Fin whales.

Observations on the external characters of the southern whales have been made with two principal objects: first, to collect sufficient material for an adequate description of each species and its range of individual variation, and secondly, to discover whether there exist any subspecies or races which might imply some form of segregation of the stocks of whales. On the first point all that need be said here is that full descriptions of the external characters and their variation (often accompanied by numerous photographs) are to be found among the publications mentioned above; and the measurements of bodily proportions at least of Blue and Fin whales, and perhaps also of Humpback and Sei whales, in the South Atlantic sector of the Southern Ocean, will perhaps be regarded as sufficiently extensive to establish mean values and the approximate range of variation. Some differences in the bodily proportions at different stages of growth have also been demonstrated, the anterior part of the body being relatively larger, and the posterior part relatively smaller, in the full grown than in the young whale. On the second point little more than negative evidence is available, but the question deserves more detailed consideration.

The specific differences between Blue, Fin and Humpback whales are obvious and clear cut. The distinction between the Sei whale and Bryde's whale is not so evident, but it seems to be accepted that they are distinct species. Members of the Discovery Committee's staff have not had an opportunity of making a proper examination of any example of Bryde's whale; but although it is in most respects very similar to the Sei whale its coarse baleen is said to be quite different from the fine baleen of the latter species, and certain differences in the skeleton are described by Lonneberg (1931) (see also Andrews, 1916*a*, p. 379, and Olsen, 1913). Bryde's whale is remarkable for its apparently very limited distribution. It has not been identified with certainty except at South African stations, and on one occasion in the West Indies.

It cannot be said that any subspecies or races have been proved to exist. We have to consider the possibility, first, of some difference between whales of the northern and southern hemispheres; secondly, of subspecies segregated or tending to segregation in different parts of the southern hemisphere; and thirdly, of more than one subspecies or race mingling in the same locality.

Since whalebone whales are relatively plentiful in high latitudes but scarce near the equator, differences might be sought between the northern and southern population. There are not sufficient data for a complete comparison between the whales of the two hemispheres, but the descriptions, for example, of the external characters of Blue, Fin, Humpback and Sei whales, published in the *Discovery Reports*, tally very closely with True's descriptions (1904) of the same species in the North Atlantic, and it is unlikely that any real difference exists.

Much the same may be said of whales in different parts of the oceans of the southern hemisphere. A detailed comparison of the measurements and external characters of Blue and Fin whales taken at South Georgia and South Africa has been made by Mackintosh and Wheeler (1929), but no differences could be distinguished. Matthews also (1937, 1938*c*) finds no differences between Humpback and Sei whales of South Georgia and South Africa. He discusses, however, certain colour varieties of Humpbacks, distinguished by the relative amount of dark and light pigment and originally described by Lillie (1915). He shows that while individuals of different colour groups mingle freely with one another, there is some evidence that in different parts of the world the proportions of the various colour classes may differ more or less constantly within the schools. This point is referred to again on p. 246. Matthews, however, agrees with Olsen's opinion (1914–15) that 'having regard to the extraordinary variability of the Humpback in the matter of colour, one can scarcely attribute much systematic importance to this character'.

Whalers in the Antarctic speak of the *Myrbjönner* as a distinct race of Blue whales. These are small whales which appear to be distinguished by a large quantity of pale spots on the dorsal surface. They are commonly noticed on the whaling grounds east of the Greenwich meridian, and are sometimes held to be fully grown. They may represent a colour variety of Blue whales, for there is some variation in the quantity of pale spots in this species; but it seems certain that they are not fully grown. Mr P. R. Crimp, who has undertaken a considerable series of biological investigations in factory ships, has examined examples of *Myrbjönner*, and by inspection of the reproductive organs has found them always to be sexually immature. Certain small Fin whales have been similarly distinguished. These are of a darker shade than others, with the pigment spreading a little farther round the ventral surface, and they are said to be common around Graham Land and the South Shetland Islands. These again Mr Crimp has found to be sexually immature, and it must be supposed that they also represent a colour variety which is perhaps more noticeable in immature than in adult whales.

SIZE RANGE

There is little material for an accurate estimation of the average size at birth of any of the species of whalebone whales. Mackintosh and Wheeler (1929) take the mean length of Blue and Fin whales at birth as 7·0 m. (23·0 ft.) and 6·5 m. (21·3 ft.) respectively. These figures were based on available records of the largest foetuses and smallest calves, and there is nothing in the Discovery Committee's more recent records to suggest modification of these figures except for one Blue whale foetus (of whale no. 1761) which measured 7·46 m. (24·5 ft.). The International Statistics quote a few instances of Blue whale foetuses measuring between 7 and 8 m., but these are very rare, and I can find only two records of Fin whale foetuses exceeding about 6·7 m. (22 ft.). The Statistics do not mention any very small calves, but the (earlier) British Museum Statistics record a Blue whale calf of 7·7 m. and three Fin whales measuring between 7 and 8 m. It is not to be expected that the length at birth is always exactly the same in any one species, and Blue and Fin foetuses exceeding 7·0 and 6·5 m. are probably above the average of this length. If it were worth while for the whalers to take the youngest calves we might well find a few measuring a little less than 7·0 and 6·5 m. It appears then that these lengths are not far from the true average lengths at birth, and in the absence of more precise data they may provisionally be accepted as correct.

Matthews (1937) estimates that Humpbacks are born at a length of about 4·5–5·0 m., and (1938*c*) that Sei whales are born at about 4·5 m. Here we have less data, but the figures are quite compatible with the maximum foetal measurements given in the International Statistics. As to the Southern Right whales, the International Statistics, no. XI, p. 36, record three foetuses of 17 ft. 2 in., 19 ft. 4 in. and 19 ft. 9 in., i.e. 5·2, 5·9 and 6·0 m. These seem remarkably large for this species, and it appears that birth must take place at about 6·0 m., for the Discovery records include a calf which measured 6·5 m.

Table 2. *Size range. Largest and smallest whales measured by Discovery Committee's staff*

	Largest			Smallest			Total no. of whales
	Whale no.	Metres	Feet	Whale no.	Metres	Feet	
Blue males	3521	26·65	87′ 5″	823	11·85	38′ 10″	680
Blue females	667	28·50	93′ 6″	3422	12·75	41′ 10″	711
Fin males	356	22·60	74′ 2″	891	12·30	40′ 4″	1131
Fin females	478	24·50	80′ 5″	1097	12·75	41′ 10″	996
Sei males	3272	16·15	53′ 0″	D 40	11·30	37′ 1″	65
Sei females	1526	17·10	56′ 1″	952	10·45	34′ 3″	156
Humpback males	340	14·75	48′ 5″	D 15	8·00	26′ 3″	31
Humpback females	321 388	14·90	48′ 11″	D 90	9·50	31′ 2″	32

The largest and smallest whales measured by the Discovery Committee's staff are shown in Table 2. The minimum measurements are of little significance, and a better indication of the length range of the whales on which observations were made is given in Table 3. Here the shore station measurements are a little more reliable than those from factory ships because the former were all taken by trained observers, whereas in factory ships some of the measurements were necessarily made by members of the whaling personnel. In the International Statistics there are records of Blue whales up to 102 ft., Fin whales up to 88 ft., and Sei and Humpback whales up to 57 ft. While it is quite possible that these maxima may be correct, they cannot, for reasons given on p. 228, be regarded as fully authenticated. However, the maximum sizes included in the limited Discovery data must obviously be exceeded from time to time, and it may be mentioned that Major F. A. Spencer, while acting as whaling inspector in the 'Southern Princess', confirmed the measurement of an 85 ft. (25·9 m.) female Fin whale.

WEIGHT

Information on the weights of whales is very scanty, and the present notes are intended only to give a rough indication of the weights of large whales and a summary of the literature on the subject. Table 4 is a list of authentic instances of whalebone whales which have been weighed piecemeal during the process of dismemberment, and full details of the weights in parts (except the last) are available in the references. The

Table 3. *Length frequencies of whales examined*

Lengths in half-metres	Measurements at South Georgia, Saldanha Bay, and Durban, 1925–31										Measurements in factory ships, 1939–41					
	Blue		Fin		Sei		Hump-back		Southern Right		Blue		Fin		Hump-back	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
6·5–7·0	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
7·0–7·5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7·5–8·0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8·0–8·5	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—
8·5–9·0	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9·0–9·5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9·5–10·0	—	—	—	—	—	—	5	3	—	—	—	—	—	—	—	—
10·0–10·5	—	—	—	—	—	1	—	2	—	—	—	—	—	—	—	—
10·5–11·0	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—
11·0–11·5	—	—	—	—	1	—	3	2	—	—	—	—	—	—	—	—
11·5–12·0	1	—	—	—	1	1	3	2	—	—	—	—	—	—	—	—
12·0–12·5	—	—	1	—	3	5	2	1	1	—	—	—	—	—	—	1
12·5–13·0	—	1	5	2	2	1	5	4	—	—	—	—	—	—	—	—
13·0–13·5	—	1	6	1	5	1	6	3	—	—	—	—	—	—	—	—
13·5–14·0	—	1	18	3	8	3	—	5	1	—	—	—	—	—	—	—
14·0–14·5	—	—	20	6	10	11	2	3	—	1	—	—	—	—	—	1
14·5–15·0	—	—	22	15	19	12	2	4	—	—	—	—	—	1	—	—
15·0–15·5	—	—	27	23	11	20	—	—	—	1	—	—	1	—	—	—
15·5–16·0	1	—	24	23	4	42	—	—	—	—	—	—	—	2	—	—
16·0–16·5	1	6	33	27	1	41	—	—	—	—	—	—	6	2	—	—
16·5–17·0	6	9	35	27	—	15	—	—	—	—	—	—	11	7	—	—
17·0–17·5	15	8	36	25	—	2	—	—	—	—	—	—	17	11	—	—
17·5–18·0	27	20	57	34	—	—	—	—	—	—	—	—	18	8	—	—
18·0–18·5	44	32	65	38	—	—	—	—	—	—	—	—	33	35	—	—
18·5–19·0	31	30	95	41	—	—	—	—	—	—	1	1	53	32	—	—
19·0–19·5	42	44	134	54	—	—	—	—	—	—	1	3	53	26	—	—
19·5–20·0	31	33	193	56	—	—	—	—	—	—	7	1	91	38	—	—
20·0–20·5	27	43	163	55	—	—	—	—	—	—	13	4	141	45	—	—
20·5–21·0	35	28	120	61	—	—	—	—	—	—	12	8	91	46	—	—
21·0–21·5	29	29	61	107	—	—	—	—	—	—	12	11	72	71	—	—
21·5–22·0	43	14	12	118	—	—	—	—	—	—	9	7	32	82	—	—
22·0–22·5	32	28	3	115	—	—	—	—	—	—	10	10	6	62	—	—
22·5–23·0	37	17	—	96	—	—	—	—	—	—	18	8	3	69	—	—
23·0–23·5	40	26	—	46	—	—	—	—	—	—	22	17	—	29	—	—
23·5–24·0	57	34	—	14	—	—	—	—	—	—	16	14	1	16	—	—
24·0–24·5	63	30	—	8	—	—	—	—	—	—	17	19	—	3	—	—
24·5–25·0	47	39	—	1	—	—	—	—	—	—	9	18	—	1	—	—
25·0–25·5	41	51	—	—	—	—	—	—	—	—	5	14	—	—	—	—
25·5–26·0	22	61	—	—	—	—	—	—	—	—	2	20	—	—	—	—
26·0–26·5	7	59	—	—	—	—	—	—	—	—	2	12	—	—	—	—
26·5–27·0	1	35	—	—	—	—	—	—	—	—	3	13	—	—	—	—
27·0–27·5	—	19	—	—	—	—	—	—	—	—	1	11	—	—	—	—
27·5–28·0	—	9	—	—	—	—	—	—	—	—	—	2	—	—	—	—
28·0–28·5	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28·5–29·0	—	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—

original measurements except for the third and tenth in the list, were made in metres and kilograms. The total weights are given as the sum of the weighed parts, but do not appear to make allowance for the loss of fluids, except that two of them include an estimate of the weight of blood. Heyerdahl (1932) notes this point and puts the blood content at 8 % of the body weight. Laurie (1933) refers to an additional Blue whale of 29·5 m. which was believed to have weighed 163·7 tons. Schultz (1938) gives a list of records of the lengths and weights of whales which includes nearly all those shown in Table 4 together with a considerable number of foetuses, the latter being quoted from Ommanney (1932, p. 463).

Table 4. *Weights of whales*

Species	Sex	Length		Girth in metres	Weight		Reference for weight in parts
		Metres	Feet		Kilograms	Tons	
1. Blue	♀	27·18	89·2	13·90	122,004*	120·1	Laurie, 1933
2. Blue	♂	20·30	66·6	11·05	48,903†	48·1	" "
3. Blue	?	23·77	78·0	10·67	64,008*	63·0	Andrews, 1916*b*; Laurie, 1933
4. Fin	♀	20·80	68·2	8·50	53,800†	52·9	Zenkovic, 1937
5. Fin	♀	19·90	65·3	8·50	48,600†	47·8	" "
6. Fin	♂	18·85	61·8	7·20	33,996†	33·5	" "
7. Humpback	♀	13·90	45·6	9·40	32,374†	31·9	" "
8. Humpback	♂	12·92	42·4	—	27,880†	27·4	" "
9. Grey	♀	13·35	43·8	—	31,466†	31·0	" "
10. Minke	?	4·88	16·0	—	1,270	1·25	Brit. Mus. records

* Blood included. † Blood not included.

Since direct weighing naturally presents enormous difficulties, it would be desirable to work out a formula or curve by which the weight can be calculated from measurements. Such formulae have been proposed from time to time but cannot of course give more than rough estimates. Guldberg (1907) assumed that the specific gravity of a whale is equal to that of water, and took the greatest girth of the body as the common base of two cones of which the snout and tail formed the apices. His formula is $V = \frac{\pi L D^2}{12}$, where V is the volume of the whale, D the diameter of the base of the cones and L the total length. Heyerdahl (1932), taking into consideration the known weights of two whales, proposed the following formula: $V = \frac{LO^2}{41} \left(\text{or } \frac{LO^2}{44} \text{ in fat whales}\right)$, where O is the girth. On the principle that the weight should vary as the cube of the linear dimensions, Laurie (1933) drew separate curves based on each of the Blue whale weights in Table 4 and found that they agreed fairly well. They indicate that a Blue whale 50 ft. long would weigh about 20 tons, but a 100 ft. whale would weigh about 160 tons. Zenkovic (1937) criticized Guldberg's formula and found a better agreement with known weights by $V = \frac{LD^2}{3}$ $\left(\text{or } \frac{LD^2}{4} \text{ for Humpbacks}\right)$, where D is the greatest height of the body on the flensing platform after removal of the head. Schultz (1938) drew a curve based on known weights and deduced a formula which 'may be written

$$W = 0{\cdot}0000269\, L^{2{\cdot}789}$$

when the weight is in kilograms and the length in centimetres'. There must, of course, be a considerable variation in the weight of individual whales of a given length.

YIELD OF OIL

The amount of oil to be obtained from a whale is an important subject, but, like the matter of weight, it will be dealt with here only very briefly on account of the difficulty of obtaining precise data. Whale oil is normally measured by the barrel (equivalent to one-sixth of a ton) and the production of whale oil is usually quoted in terms of the 'Blue-whale equivalent', in which it is assumed that on the average the yield from a Blue whale is equal to that from 2 Fin, 2½ Humpback or 6 Sei whales. This formula is good enough for a rough indication of the average yield from the different species. Thus in the International Statistics, no. XII, p. 13, the average production is given for all seasons in the Antarctic from 1924–5 to 1937–8, and we see that the yield of oil per Blue-whale unit generally varies between about 90 and 110 barrels. This means that from average whales in the Antarctic about 100 barrels are expected from a Blue whale, about 50 from a Fin, about 40 from a Humpback and about 17 from a Sei. The yield from individual whales must obviously vary very much according to size and physiological condition. It also varies according to the efficiency of the technical methods of the whaling industry, and since the oil from different whales is mixed in the factories' tanks without separate measurement it is extremely difficult to assess the average yield of oil from whales of a particular size. The Blue whale equivalent is perhaps as good a formula as can be devised, but inferences should be drawn from it with a good deal of caution, for it is probably not claimed to be quite accurate even as a ratio of the general average yield from the four species. For example, during the Antarctic whaling season the average yield of oil per Blue-whale unit tends to increase from month to month. This undoubtedly is largely caused by the increasing fatness of the whales during their period on the Antarctic feeding grounds. But as the season goes on there is also an increase in the proportion of Fin whales in the catches (see p. 270), and if the yield from an average Fin whale should in fact be a little more than half the yield from an average Blue whale on the Antarctic grounds there would be some increase in the yield of oil per Blue-whale unit even if there had been no increase in fatness. The increased yield is not therefore a reliable criterion of the improved condition of the whales. This element of uncertainty is recognized by Bergersen, Lie and Ruud (1939, p. 13).

FOOD IN THE ANTARCTIC AND IN WARMER WATERS

It is well known that whalebone whales feed during the Antarctic summer on the shoals of the shrimp-like crustacean, *Euphausia superba*, collectively known as krill, which inhabit mainly the surface waters of the Antarctic. This organism is of great importance in the general economy of the sea in high southern latitudes, and its significance as a supply of food for various animals besides whales has been illustrated by Hart (1942, Text-fig. 16). Its life history and distribution are the subject of separate reports already published or in preparation (see Bargmann, 1937; and Fraser, 1936). The life history need not be considered here, and of its distribution it need only be said that the work of the Discovery Committee's ships has clearly shown that it is confined to the region south of the Antarctic convergence (see Deacon, 1937, p. 22), and that it is rarely found even so far north as the convergence, its principal habitat being between the 3° C. isotherm and the coastal region of the Antarctic continent. The Committee has accumulated very extensive data on its distribution. Mr J. W. S. Marr was preparing a detailed report on the subject, but his work was interrupted by the outbreak of war, and the full results are therefore not yet available.

Here only some basic facts about the diet of whales will be discussed. To begin with, there is no doubt about the specific identity of the krill. Several members of the Discovery Committee's staff and various other biologists who are thoroughly familiar with the species have examined the contents of thousands of whales' stomachs both at South Georgia and in factory ships operating on various parts of the oceanic whaling grounds, and these observers, not to speak of the personnel of the whaling factories, could not fail to note any substantial variation of diet or any significant mixtures of species in the food. This, however, is not to say that nothing but krill is ever to be found in the stomachs of whales taken in Antarctic waters, and it is worth while here to give some figures to demonstrate the heavy consumption of krill by the whales and the extent to which other forms of food are found in their stomachs.

The diet of whales at South Georgia, is dealt with by Mackintosh and Wheeler (1929, pp. 361–4), who found that the vast majority of stomachs examined contained plenty of food, and that this food consisted exclusively of *Euphausia superba* except for occasional specimens of an Amphipod known to be common in the local plankton. The Amphipod (*Parathemisto gaudichaudi*) constituted a wholly insignificant part of the diet.

Various observers have made notes on the stomach contents of whales taken on the larger whaling grounds of the Antarctic. Perhaps the most detailed observations available to me are those of Major F. A. Spencer, who acted as Whaling Inspector in the factory ship 'Southern Princess' during the seasons 1936–7 and 1937–8. He examined the stomachs of several hundreds of whales, and noted the quantity of krill present, whether large or small specimens predominated, instances of empty stomachs and instances of any food other than krill. Table 5 is a rough analysis of these notes. The figures are not exact, for no precise measurement could be made of the amount of krill in a stomach, and it is not always certain whether absence of krill is to be attributed to damage by the harpoon or to the fact that the whale had not been feeding. This is of little importance however, for the table is intended only to show that most of the whales were eating plenty of krill.

Table 5. *Quantities of krill found in the stomachs of whales in the Antarctic*

	'Southern Princess', 1936–7						'Southern Princess', 1937–8					
	Blue		Fin		Humpback		Blue		Fin		Humpback	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Much	135	74	69	57	33	97	179	73	98	51	12	92
Moderate	8	4	2	2	—	—	2	1	4	2	—	—
Little	30	17	27	22	1	3	37	15	36	19	—	—
Empty	9	5	23	19	—	—	27	11	54	28	1	8

At the beginning of the season 1936–7 there is only a general note that the stomachs of nearly all whales taken (except on two days) contained large quantities of krill. Thereafter notes were made for individual whales, and we see that the figures are on the whole very similar for the two seasons. Full stomachs are found in 70–80 % of Blue whales, 50–60 % of Fin whales, and over 90 % of Humpbacks. There was some indication that empty stomachs may be found a little more often in the early and late part of the season, but a larger body of material would be needed for a reliable comparison month by month. Large and small krill occurred all through the season, and the stomachs as often as not contained mixtures of sizes.

The fact that krill is almost the exclusive diet of these whales in the Antarctic may be demonstrated by a list of the only organisms other than krill found among the hundreds of stomachs examined by Major Spencer. These are shown in Table 6. It will be seen that fish are occasionally eaten (probably always the familiar 'ice-fish'), and that squids are occasionally present. Usually, and possibly always, krill was also present. In only one instance was there a substantial diet of anything other than krill. That was when fifty fish were found in one stomach on 8 January 1938, and even then krill was also present. The 'Southern Princess' was working between 30 and 95° E in 1936–7 and between 70 and 95° E in 1937–8. Nothing but krill is recorded in the stomachs of Humpbacks.

In the season 1940–1, Mr Crimp worked in the factory ship 'Svend Foyn' in another part of the Antarctic, 30–55° W. Blue whales were scarce and Humpbacks were not taken, but in 156 stomachs of Fin whales which he examined 54 % had much krill, 17 % a moderate amount, 28 % little and 1 % none.

Another shrimp-like organism, very similar to the true krill, is known to occur in certain coastal waters around the Antarctic continent. This is *Euphausia crystallorophias.* Its distribution has not been fully worked out, but it has been found by the 'Discovery II' here and there around the Graham Land Archipelago and in considerable swarms in the southern part of the Ross Sea. It appears to be confined to shoal waters around the continent, and may possibly replace the krill in such regions. It does not appear to have been identified in the stomachs of whales, but might well form the food of any that penetrate to its habitat. Minke whales are commonly found in the southern part of the Ross Sea, but it is doubtful whether more than a small fraction of the Blue and Fin whale populations approach the continental coastal regions.

Table 6. *Food other than krill found in the stomachs of whales in the Antarctic*

Date	Whale	Type of food	Amount of krill also present
		(*a*) 'Southern Princess', 1936–7	
27. xii. 36	Blue ♀, 77 ft.	One 12 in. fish	Large quantity
3. i. 37	♀, 78 ft.	Four fish of 8–12 in.	,, ,,
25. i. 37	♂, 80 ft.	One 15 in. fish	,, ,,
24. ii. 37	Fin ♀, 76 ft.	Two fish of 2 and 14 in.	,, ,,
27. ii. 37	♀, 73 ft.	One squid of 20 in.	,, ,,
12. iii. 37	♂, 70 ft.	One fish	,, ,,
		(*b*) 'Southern Princess', 1937–8	
2. i. 38	Blue ♂, 79 ft.	One 9 in. fish	Not stated
8. i. 38	♀, 72 ft.	50 fish of 9–12 in. Described as 'the usual long, thin, semi-transparent fish'	'Among krill'
12. i. 38	♂, 82 ft.	One 18 in. fish	Large quantity
13. i. 38	♂, 73 ft.	One 12 in. fish	Not stated
28. i. 38	♂, 77 ft.	One 12 in. fish	Large quantity
1. ii. 38	♀, 90 ft.	Half a jellyfish of 15 in. diam.	,, ,,
10. ii. 38	♀, 74 ft.	One 25 in. squid	,, ,,
11. ii. 38	♀, 82 ft.	One 7 in. squid	,, ,,
23. ii. 38	♀, 81 ft.	One 24 in. squid	,, ,,

There can, in any case, be little doubt of the general rule that whales in the Antarctic in summer feed heavily and almost continuously on the krill, and that for all practical purposes the krill may be regarded as an exclusive diet. Such whales as remain in high latitudes throughout the winter (see pp. 238 and 250) probably continue to feed on krill, but since no whaling is now done in winter we have no positive data on that point.

The northward migration takes most whales in winter far beyond the northern limit of *Euphausia superba*, and it has been shown (Mackintosh and Wheeler, 1929, pp. 361–4) that little or no food is present in the stomachs of whales caught in winter at Saldanha Bay (Cape Province). Over 50 % of the stomachs of Blue and Fin whales examined were empty, and nearly all the rest contained no more than small quantities of various species of Euphausiidae. Very few Humpbacks and Sei whales were inspected at Saldanha Bay, but Matthews (1937, p. 43, and 1938*c*, p. 234) shows that of four Humpbacks two had empty stomachs and two had fed on fish, and that of nine Sei whales seven had empty stomachs and two had a small quantity of crustacean remains. Of the whales examined at Durban in 1930, 96 % of the stomachs were empty. Table 7 is an analysis of these observations. It does not include those in which blood was seen to be present, for that might mean that the stomach had been damaged by the harpoon with consequent loss of the contents. It is clear that the whales taken at Durban had scarcely been feeding at all.

Table 7. *Amount of food found in the stomach of whales examined at Durban*, 1930

	Blue	Fin	Sei	Humpback	Total	%
Much	—	—	—	—	—	0
Little	3	2	—	—	5	4
Empty	48	47	8	9	112	96
Fish, etc.	—	—	—	—	—	0

In certain temperate coastal regions some of the whalebone whales find an extra article of diet in the 'lobster krill' which is the pelagic post-larval (or *Grimothea*) stage of the crustacean, *Munida gregaria*. Descriptions of this organism and its habits are given by Matthews (1932) and Rayner (1935). Swarms of *Grimothea* occur locally in great abundance in the neighbourhood of the Falkland Islands, Patagonia and Tierra del Fuego, and around the coasts of New Zealand. It is not found anywhere in Antarctic waters, and does not appear to have been recorded from such places as Kerguelen or so far north as South Africa, so that it must play a minor part in the nutrition of the southern stocks of whales as a whole. Sei, Humpback and Right whales taken off the Falkland Islands are recorded as feeding on it, and it is evidently of some importance to Humpbacks passing through the coastal waters of New Zealand in winter. Ommanney (1933, p. 249) notes that the south-bound Humpbacks here have a certain amount of food in their stomachs, some of which has been identified by Matthews as lobster krill, though the north-bound whales generally have empty stomachs. It is not clear whether it is ever eaten by Blue and Fin whales. The swarming of *Grimothea* may take place throughout the year though it is most commonly recorded in the summer months, and it may be that it forms a major part of the diet of Sei whales, which seldom come so far south as the zone inhabited by *Euphausia superba* except at the warmest time of year.

The principal purpose of these notes is to show that the majority of southern whalebone whales feed heavily in the Antarctic in summer and find little to eat in warmer waters in winter. The fact that whales arriving on the southern whaling grounds early in the Antarctic summer are known to have thinner blubber than at the end of the season (see p. 250) itself suggests that they have had comparatively little to eat during the winter. On the whole we are justified in concluding that during the summer in the Antarctic, Blue, Fin and Humpback whales consume large quantities of krill, and that in warmer regions in winter they manage to a large extent without food except for a very meagre diet of certain small Euphausiidae, some lobster krill here and there, and perhaps an occasional meal of fish. There is perhaps some doubt as to the extent to which Humpbacks can feed on fish during the winter, but it is not likely that they find feeding grounds comparable with those of the Antarctic. We know little of the habits in winter of the majority of adult Blue and Fin whales which do not approach coastal waters and whose stomachs cannot be examined, but since they are in comparatively poor condition when they return to the southern feeding grounds we must suppose that they also find little to eat in warmer waters. Of the food of Sei whales comparatively little is known for certain.

PARASITES AND DISEASES

It will not be necessary here to review the whole subject of parasitism in whales, but the occurrence of parasites is of some assistance to the investigation of whale migration. The most familiar external parasites of whales are the barnacles, the Copepod, *Pennella*, the sea-lice (Amphipoda), and the diatoms. Right whales and Humpbacks are particularly subject to barnacles and lice, but the diatom film probably infects all the cetaceans which frequent Antarctic waters.

The following is a list of external parasites commonly found on whalebone whales in the south:

Cirripedia (barnacles)
Conchoderma auritum
C. virgatum
Coronula diadema
C. reginae
Xenobalanus globicipitis

Copepoda
Pennella balaenopterae
Balaenophilus unisetus

Amphipoda
Cyamus ovalis
C. balaenopterae
Paracyamus erraticus
P. boopis
P. gracilis

Protozoa
Haematophagus megapterae

Diatomacea
Lycmophora lyngbyei
Cocconeis ceticola
C. imperatrix
C. gautieri
C. wheeleri
Navicula spp.
Gyrosigma (*Rhoicosigma*) *arcticum*

Two papers by Nilssen-Cantell (1930, 1939) may be consulted for further information on the parasitic Cirripedes. He mentions *Conchoderma auritum* from Blue, Fin and Humpback whales, usually attached to the shells of *Coronula* or to the baleen plates. *Conchoderma virgatum* is recorded as attached to *Pennella* but is known from a variety of hosts besides whales. *Coronula diadema* has been found on Humpbacks and Blue whales, and *C. reginae* on Humpback, Blue and Fin whales. *Xenobalanus* is noted on Blue, Fin and Sei whales. These Cirripedes are not the cause of the typical pits and scars seen in various stages of healing on Balaenopterids in southern seas. *Coronula*, for example, leaves only a purely superficial impression (see Mackintosh and Wheeler, 1929, plate xxxvii).

Pennella is a well-known parasite of Blue, Fin and Sei whales, but it is doubtful whether it occurs on Humpbacks. Although it is rooted deeply in the blubber the whales appear to have the faculty of casting it off by some healing process, for specimens have been found on the point of ejection. As Rayner (1940, p. 248) points out, there is little doubt that a type of whale mark used at first by the Discovery Committee was for this reason a failure. Although some hundreds of whales were marked with it, none of this pattern of mark has been recovered, and it is to be supposed that they were all ejected as easily as specimens of *Pennella*. Subsequently a mark was used consisting of a steel tube which normally becomes completely embedded. This was successful, and such marks have been retained for periods up to six years, but it is quite possible that some of them are also ejected.

Pennella and *Coronula* provide some evidence of the migrations of whales. 'Ectoparasites in general are rarely found on Blue and Fin whales at South Georgia. Infection seems to take place more easily in warmer waters of the South African coast, when *Pennella* is particularly common. At South Georgia such external parasites as do occur are generally fully grown, while those observed at South Africa included, at any rate in the case of *Coronula* and *Pennella*, young ones in all stages besides the fully grown individuals. It appears that whales become infected with these external parasites during their stay in warmer waters, but lose them on migrating to the colder waters of the south.... The ability of a whale to throw off the *Pennellae* which most commonly attack Blue and Fin whales, seems to have some physiological significance, for it is often found that a whale taken at South Georgia with a number of these parasites in its blubber is suffering from some internal growth or disease' (Mackintosh and Wheeler, 1929, p. 373). The occurrence of *Pennella* or its stumps or scars in a whale in the Antarctic is thus evidence that that whale has migrated from warmer latitudes, but we have records only from the Antarctic in summer and warmer waters in winter, and for the evidence of migration to be conclusive we should need to prove that the parasites are not contracted in winter in the Antarctic.

Balaenophilus is a Harpacticid Copepod which inhabits the baleen plates of rorquals. Among the Discovery Committee's records it is noted on Blue and Sei whales.

The Cyamids, or whale lice, seem always to be plentiful on southern Right whales and Humpbacks, but are rarely found on the rorquals. Barnard (1932) identifies *Cyamus ovalis*, *Paracyamus erraticus* and *P. gracilis* from Right whales. *Paracyamus boopis* is commonly found on Humpbacks, but *P. erraticus* has also been found on this whale. *Cyamus balaenopterae* has been found on Blue and Fin whales.

Haematophagus is another inhabitant of the baleen plates, and very common on Blue, Fin, Humpback and Sei whales. Woodcock and Lodge (1921) describe *H. megapterae* (found on Humpbacks) as a ciliate of the family Stentoridae.

The list of Diatoms given above is taken from Hart (1935). He mentions also (p. 254) a few other species which he considers occurred fortuitously on the skin of whales and did not form part of the true diatom film.

The familiar oval scars which are always plentiful on southern Blue, Fin, Humpback and Sei whales are different from the scars occasionally left by *Pennella*, though they are sometimes secondarily infected by that parasite. They are incurred in the warmer latitudes where they are seen as clean-cut open pits in the blubber, and although every stage in the process of their formation and healing has been traced it seems that no satisfactory explanation of their cause has yet been found (see Mackintosh and Wheeler, 1929, pp. 373–9). The presence in whales in the Antarctic of healed scars which are clearly the remains of the open pits is evidence of migration similar to the evidence provided by parasites such as *Pennella*, and since the scars have the appearance of permanency, and since an abundance of scars is correlated with an accumulation of old corpora lutea in the ovaries (see p. 226) it can be said that a whale with numerous scars must almost certainly be older than one with few.

Internal parasites are often very abundant in whalebone whales. Trematodes, Cestodes, Nematodes and Acanthocephala are commonly present, but it is not necessary here to enumerate the species which have been recorded, as a very full list is given by Baylis (1932). It does not appear that the frequently heavy infection of the intestines with tape worms and Acanthocephala is necessarily correlated with an unhealthy condition of the whale, but various organs may be exceptionally infected, for example with Nematodes, to an extent which amounts to a disease. The frequency of such exceptional infection cannot be estimated owing to the difficulty of making a systematic examination of the internal organs of any large number of whales.

Whales are occasionally subject to disease, and in the same category it will be convenient to include injuries and other abnormalities. Very little is known of the diseases, but they are not unimportant as they may have a bearing on natural mortality. Observations made by members of the Discovery Committee's staff and by various whaling inspectors may be summarized as follows. Externally, callosities and apparently bony protuberances, sometimes of considerable size, have been noted, and in one Blue whale the jaw bones were deformed. Major Spencer (in the 'Southern Princess') noticed on a number of whales certain circular patches suggestive of ringworm, and some similar marks have been described on the skin of whales at South Georgia. In one or two whales an opaque lens has been noted in one eye. Healed wounds, sometimes probably caused by harpoons, are not uncommon; a flipper has occasionally been lost;[1] and the dorsal fin, especially it seems in male Blue whales, is not infrequently truncated or deformed. Internally the pathological features most commonly noticed are various growths, tumours, nodules, cysts, etc., which may vary in size from an inch or two to two feet in diameter. Sometimes they are described as hard, bony, or calcareous, and sometimes as containing a pus-like fluid. Such bodies of one kind or another have been found loose in the abdominal cavity on several occasions, but have been noted also in the peritoneum, in the stomach, in the uterine mesentery, in the wall of the rectum, in the kidney, between the lungs and pleura, in the trachea, in connective tissue under the blubber, in the shoulder and even between the vertebrae. Among examples of this kind, Dr E. H. Marshall, who visited the Ross Sea in the factory ship 'C. A. Larsen', noted multiple fibromata of the trachea (one being 'larger than a cricket ball'), a large abscess involving the shoulder joint, and a very large pyonephrosis. On several occasions a form of pleurisy has been noticed in which there were extensive adhesions of the lungs to the pleura. Such diseases have seldom been recorded, but might be observed more often if it were not for the difficulty of examining the viscera. A degenerate or deformed foetus has been seen from time to time, and such foetuses are generally large ones. Mr J. W. S. Marr, working in the factory ship 'Terje Viken', found in a 75 ft. Fin whale five foetuses measuring 8–14 ft. They were grotesquely deformed and had evidently been long dead, for each was invested in a hard, stony concretion. A smaller concretion may have represented a sixth foetus. The cow appeared to be in a perfectly healthy condition. One or two instances of such a litter have before been known to occur, but it is doubtful whether any survive to birth.

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[1] Commander S. A. Brooks (in the 'Sourabaya', 1934–5) watched the swimming of a pair of Blue whales while he was in a catcher which was chasing them. When one of them (a male) was caught, the right flipper was found to be completely missing, the shoulder being healed and covered with blubber; but it was noted that the whale's swimming and control had apparently been unaffected.

Several whaling inspectors have from time to time observed whales with noticeably tinted blubber. The colour has been described as pink, yellow or orange. It was noted in both Blue and Fin whales, but only in one or two among many hundreds. I have heard no definite explanation of it, but it may possibly be pathological.

One other abnormality worth mention is an apparent example of albinism in a Fin whale. Commander H. Buckle (whaling inspector in the 'Southern Empress', 1937–8) reported a 68 ft. male Fin whale which was 'almost pure white'.

BREEDING, GROWTH AND AGE

In recent years a good deal of new material relating to the breeding, growth and age of whales has been collected by members of the Discovery Committee's staff and other biologists who have sailed in factory ships to the Antarctic. Work on this material, which includes records of large numbers of ovaries, has been interrupted by the war, but it is to be hoped that it will be resumed in the future, and much progress should be revealed when the results are available. In the meantime this section of the present report will be mainly confined to a summary of previous work and the general principles on which breeding, growth and age have been investigated. Some comments also are needed on the accuracy of previous estimations of the mean length at sexual maturity.

THE MEAN LENGTH AT SEXUAL MATURITY

The size and age at which whales become adult require special attention in any study of the life history of whales. It is always important to be able to estimate the percentage of immature whales in the catches, and almost any investigations of breeding and growth must start with the distinction between the mature and the immature.

It is found that whales of the same species and sex become adult at a length which normally varies within rather narrow limits. Consequently, the majority of whales can be distinguished as mature or immature by the length alone; and having estimated the average length at which whales become mature we can calculate with some confidence the percentage of immature whales in catches for which only the species, sex and length are recorded.

The mean lengths at which Blue and Fin whales become adult were estimated by Mackintosh and Wheeler (1929, p. 417) to be 22·6 and 23·7 m. for Blue males and females and 19·5 and 20·0 m. for Fin males and females respectively, and Laurie (1937, p. 231) considers that the data he obtained in a season's work in a factory ship confirm these figures.

Matthews (1937 and 1938*c*) estimates the corresponding lengths in Humpback and Sei whales to be as follows:

Humpback males	12·0 m. or 39 ft. 4 in.
Humpback females	12·5 m. or 41 ft. 0 in.
Sei males	13·5 m. or 44 ft. 3 in.
Sei females	14·5 m. or 47 ft. 7 in.

These figures are based on all the Humpback and Sei whales examined at South Georgia and South Africa from 1925 to 1931, and must therefore be taken as the nearest approximations which can be made at present. These two species, however, were scarce, and during the whole period were far fewer than the Blue and Fin whales on which the original estimates were based.

Since we now have the additional material for Blue and Fin whales from 1927 to 1941 the original estimates for these two species can be re-examined. Table 8 shows all the whales within certain lengths which can, from an examination of the records, be classed as certainly or almost certainly sexually mature or immature, and they include the longest immature and the shortest mature whales. The purpose of the table is to show in what degree total length is itself a criterion of sexual maturity, and the extent to which the lengths of mature and immature whales overlap. It is often difficult to draw the line between whales which should or should not be included in the table. Females are more easily distinguished as mature or immature than males, for in the latter there is little to go by except the size of the testes. Hence a considerable number of males whose testes were intermediate in size between the obviously mature or immature have been excluded. Whales are also excluded where there is any doubt of the accuracy of the total length. The numbers of immature and mature whales are given for each tenth of a metre of total length, and this perhaps comes near to splitting hairs, for we can scarcely expect to fix exactly the mean length at sexual maturity to such a small unit.

With this increased material the overlap is found to be a little more than appeared when the mean length at maturity was originally estimated, but it is still not much more than about 1·5 m. (4·9 ft.) if exceptional examples are omitted.

Blue males. The table does not indicate any amendment to the estimated length of 22·6 m. or 74 ft. 2 in. This would mean that whales measured to the nearest whole foot would be regarded as immature if less than 74 ft.

Blue females. The figures suggest that 23·5 m. (77 ft. 1 in.) would be more nearly correct than 23·7 m. (77 ft. 9 in.), but measurements about the critical length are rather scarce. If the new length were accepted, whales measuring less than 77 ft. would be regarded as immature.

Table 8. *Lengths of sexually mature and immature whales*

Blue					Fin				
Lengths in metres	Males		Females		Lengths in metres	Males		Females	
	Imm.	Mat.	Imm.	Mat.		Imm.	Mat.	Imm.	Mat.
21·0	3	—	11	—	17·0	4	—	4	—
21·1	5	—	7	—	17·1	8	—	10	—
21·2	8	—	7	—	17·2	4	—	1	—
21·3	3	—	5	—	17·3	3	—	2	—
21·4	9	1	3	—	17·4	4	—	4	—
21·5	7	1	2	—	17·5	7	1	6	—
21·6	8	1	2	—	17·6	5	—	4	—
21·7	5	1	3	—	17·7	5	—	8	—
21·8	5	1	2	—	17·8	10	—	4	—
21·9	3	1	1	—	17·9	6	—	10	—
22·0	2	2	9	—	18·0	11	—	10	—
22·1	4	1	4	—	18·1	10	—	8	—
22·2	3	2	5	—	18·2	8	—	14	—
22·3	6	1	5	—	18·3	16	1	12	—
22·4	2	1	6	—	18·4	7	—	10	—
22·5	7	1	3	—	18·5	7	1	6	1
22·6	3	3	2	—	18·6	10	3	11	—
22·7	6	6	3	1	18·7	11	2	4	1
22·8	—	4	3	—	18·8	9	3	12	1
22·9	4	2	3	1	18·9	6	4	10	1
23·0	—	5	4	1	19·0	7	2	10	3
23·1	1	7	6	3	19·1	7	4	7	—
23·2	—	4	1	2	19·2	6	18	16	2
23·3	—	9	—	1	19·3	4	12	11	3
23·4	2	8	2	2	19·4	7	18	8	2
23·5	—	8	1	4	19·5	5	19	11	4
23·6	1	4	4	5	19·6	3	20	8	4
23·7	—	9	3	6	19·7	5	22	7	3
23·8	—	14	1	4	19·8	4	24	10	8
23·9	—	12	2	8	19·9	2	22	3	8
24·0	—	9	1	2	20·0	3	36	6	13
24·1	—	9	—	7	20·1	1	37	8	9
24·2	—	6	—	12	20·2	2	37	3	6
24·3	—	8	—	5	20·3	—	34	2	12
24·4	—	19	—	7	20·4	—	43	1	8
24·5	—	5	—	11	20·5	1	36	—	14
24·6	—	5	1	5	20·6	—	33	2	13
24·7	—	8	—	11	20·7	—	32	3	18
24·8	—	13	—	6	20·8	—	25	3	22
24·9	—	7	—	10	20·9	1	34	1	21
25·0	—	6	—	10	21·0	—	38	—	26

Fin males. The original estimate of 19·5 m. (64 ft. 0 in.) was clearly a little too long. 19·2 m. (63 ft. 0 in.) is probably about right. Those measuring less than 63 ft. would then count as immature.

Fin females. The original estimate of 20·0 m. (65 ft. 7 in.) seems nearly right, but is probably too long by about 0·10 m., and the revised estimate is 19·9 m. (65 ft. 3 in.). Those measuring less than 65 ft. would then count as immature.

These revised figures should not be regarded as final. A certain amount of biological work has been undertaken in recent years in the factory ships of more than one nation, and it may be that a larger body of data will be forthcoming which may provide for more precise adjustments to the mean length at sexual maturity. In the meantime it is doubtful whether the original estimates should be disturbed, for they have been used for various calculations of the percentage of immature whales in catch statistics and remain valid for purposes of comparison, e.g. for noting any changes in the ratio of immature whales in successive years. We have to consider the effect on such calculations of revising the mean length at sexual maturity. The corrections suggested above vary only from 4 to 12 in. which seems very small, but a correction of 12 in. can make a distinct difference (of the order of 4 or 5 %) to the estimated ratio of immature whales in statistics of catches. On the other hand, it should be emphasized that such estimates can never be very accurate, for the whaler's measurements are made only to the nearest whole foot, and 12 in. is thus in any case the minimum correction that could affect such calculations.

THE REPRODUCTIVE ORGANS

Systematic examination of the reproductive organs forms the principal basis for the study of the breeding of whales. Mackintosh and Wheeler (1929) give a general account of the anatomy and physiology of the genitalia of Blue and Fin whales so far as they throw light on breeding problems, and Matthews (1937, 1938*c*) shows that in this respect Humpback and Sei whales differ very little from Blue and Fin whales. For a more detailed account of the morphology of the reproductive organs reference should be made to Ommanney (1932).

Examination of the external genitalia is not very useful except as a quick means of ascertaining whether a whale is sexually mature or immature, and even then is uncertain in borderline cases. Of the internal genitalia inspection of the uterus and mammary glands is also useful in the diagnosis of maturity and for determining the stage in the reproductive cycle, i.e. whether pregnant, lactating or resting. The size of the testis is usually, but by no means always, sufficient to show whether a male is immature or mature, but histological examination is the only unfailing method. Histological examination has also provided clear evidence of a male sexual season. Material from an adequate number of adult whales is difficult to obtain during the breeding season, and at present it can only be said that the testes become most active in the early winter months, roughly from April to June in the southern hemisphere. The ovaries are by far the most instructive of the reproductive organs. Their size and weight differentiate mature from immature females, and the ripening follicles indicate the approach to maturity or to ovulation; but most important are the corpora lutea which not only indicate the sexual condition of the whale, but reveal much of its sexual history and age.

PERSISTENCE OF THE CORPORA LUTEA OF THE OVARIES

Investigation of the growth and age of whales relies to a large extent on the persistence of old corpora lutea as recognizable bodies in the ovaries, and it is perhaps worth while to review the evidence on which this persistence is assumed. When ovulation takes place the follicle from which the ovum is discharged becomes filled with luteal tissue and forms a solid corpus luteum which in whales may measure 10 or more centimetres in diameter. If impregnation takes place the corpus persists with little change as a functional body throughout the period of gestation. On the birth of the calf it shrinks to a much smaller, tougher body which is more properly described as the corpus albicans. It has generally been found convenient to include it in the term 'corpus luteum', and to refer to 'functional' and 'old' corpora lutea, or sometimes to 'corpora lutea *a* and *b*'. If ovulation is not followed by impregnation a functional corpus luteum is formed in the same way but is presumed (by analogy with other mammals) to last for a comparatively short period before shrinking to the smaller body.

The number of these old corpora lutea to be found in a pair of ovaries of an adult whale may vary from one to over fifty, and this fact alone suggests that they may be cumulative. Whales have a definite breeding season, and since no mature female is ever found (except those which are evidently only just verging on maturity) without any corpora lutea, new or old, in the ovaries, it is evident that these bodies persist at least from one breeding season to the next. Furthermore, if the number of corpora lutea in the ovaries is plotted against the length of the whale it is found that the smaller whales (which have not grown more than 1 or 1·5 m. beyond the mean length at which sexual maturity is reached) always have comparatively few corpora lutea. The larger whales, on the other hand, may have any numbers of corpora lutea, except that the largest of all never have very few (see Mackintosh and Wheeler, 1929, p. 394). This is entirely consistent with the steady accumulation of corpora lutea, for it is reasonable to suppose that all whales continue to grow a little after reaching sexual maturity, and that some cease growing at a certain point while others go on to reach greater lengths. The minimum length at which growth ceases would be the point beyond which the numbers of corpora lutea cease to be related to the lengths of the whales, and it may also be supposed that, in the period required to attain the greatest lengths, a whale could not fail to accumulate at least a moderate number of corpora lutea. The argument is clinched by a comparison of the numbers of corpora lutea in the ovaries of sexually mature whales which have and have not reached full physical maturity. A whale is said to be physically mature when the epiphyses[1] of the vertebrae have become fused with the centra throughout the vertebral column, and it is well known that such ankylosis in any mammal marks the termination of linear growth. Wheeler (1930, p. 411) showed that in Fin whales physical maturity is reached when about fifteen corpora lutea have accumulated in the ovaries. The correlation was very remarkable, for 'of 105 whales with less than fifteen corpora lutea only two, with eleven and twelve respectively, were physically mature; while of sixty-six whales with more than fifteen corpora lutea only four, with sixteen, sixteen, twenty and twenty-one, were physically immature'. Laurie (1937, p. 236) found a similar correlation in Blue whales, nearly every whale having more than eleven corpora lutea being physically mature and nearly every whale having less than eleven being physically immature. This accumulation of such a regular number of corpora lutea at such a definite landmark as physical maturity seems to leave no doubt not only that the corpora lutea persist up to and well beyond the age at which physical maturity is reached but also that the accumulation takes place at a fairly steady rate. It can also perhaps be argued that the ossification of the vertebral epiphyses and the accumulation of corpora lutea could scarcely keep in step with one another in this way except in their relation to the age of the whale, and that therefore the females normally become physically mature at a fixed age in either species after the attainment of sexual maturity.

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[1] The epiphyses are the bony disks at each end of the centrum or main body of the vertebra. In the unfused state they are separated from the centrum by a layer of cartilage.

For these reasons there seems no doubt that the corpora lutea persist for a long time, and if they last thus from the first ovulation until beyond the point at which physical maturity is reached there seems no reason why they should ever disappear, even in the oldest whales. There is perhaps no direct proof that they do last throughout the life of the animal, but Bertram (1940, pp. 61–5) concludes that they do so in the parallel case of the Weddell seal on the ground of their frequency distribution. His argument, in essence, is that if all the old corpora lutea remain permanently visible and countable in the ovaries it would be expected that there would be progressively fewer seals possessing each number of them as the scale is ascended, whereas if the corpora lutea diminish and disappear after a certain interval, all seals over a certain age would tend to have the same number of corpora lutea, and that a certain number near the maximum would therefore occur more frequently than the lower numbers. He found, in fact, that the larger numbers became progressively scarcer and concluded that the corpora lutea persist throughout the seal's life. The same argument can be applied to Blue and Fin whales, for Laurie's frequency curves for Blue whales (1937, p. 254) and Wheeler's for Fin whales (1930, p. 417) show a gradual tailing off towards the higher numbers.

BREEDING

Inspection of the ovaries and testes, and analyses of records of foetal lengths at different times of year show clearly that there is a breeding season in the southern winter and that the period of gestation is nearly a year. This has been fully discussed in previous publications, and all that need be said here is that the birth of the calves and pairing take place over a protracted period in the southern winter. Mackintosh and Wheeler (1929, pp. 426, 429) estimated that in Blue and Fin whales the height of the pairing season is in June and July, and that Blue whales are mostly born in April and May, and Fin whales probably a little later. These estimates were based on limited data, but are not likely to be far wrong. Matthews (1937, 1938*c*) estimated that in the Humpback pairing is at a maximum in September and births in August (i.e. a little later than in Blue and Fin whales), and that in Sei whales both pairing and birth reach a peak in July.

The question whether whales are monoestrous or polyoestrous is discussed by Wheeler (1930, p. 412), and it has an important bearing on the interpretation of counts of corpora lutea. There have been frequent instances of whales having a functional corpus luteum but in which no trace of a foetus could be found in spite of a careful search of the uterus. Wheeler also mentions the case of a Fin whale with one old corpus luteum, immature mammary glands, and an unbroken vaginal band. It can at least be assumed then that ovulation is spontaneous and not, as in some mammals, dependent on coition. The protracted breeding season, together with the evident capacity of the ovaries to produce numerous Graafian follicles, very strongly suggest that each of these species is polyoestrous; that is to say that more than one oestrous cycle may take place in the course of one breeding season and that therefore more than one corpus luteum may be formed if pregnancy does not follow on the first discharge of an ovum. This is another point that still needs final proof, but that does not affect the inference that the number of old corpora lutea in a pair of ovaries is likely to be greater than the number of two-year cycles (see below) which have elapsed since the first ovulation. It might sometimes of course be equal to it, for a whale might become pregnant every two years at the first ovulation, and it is known that the corpus luteum of pregnancy inhibits the discharge of a new ovum. If it were found, contrary to expectation, that whales were in fact monoestrous, the determination of age from corpora lutea numbers would of course be enormously simplified.

In many mammals with an annual breeding season the females normally become pregnant every year. This occurs, for example, in some, and probably all, Antarctic seals (see Matthews, 1929, p. 236; Hamilton, 1934, p. 300; Bertram, 1940, pp. 59, 113). It cannot be the rule, however, in whales, for the gestation period of about a year is followed by a considerable period of lactation, and instances of females which are simultaneously pregnant and lactating are very rare. Apart from this the proportion of non-pregnant females in the catches during the period between breeding seasons is sufficiently high to show that annual pregnancy cannot possibly be the normal experience of adult females. It is difficult, however, to be quite certain of what the normal interval between pregnancies actually is. From the percentage of adult females pregnant in the catches at South Georgia, Mackintosh and Wheeler (1929, p. 431) inferred that in Blue and Fin whales pregnancy normally occurs every two years, but that the interval may sometimes be three years. Laurie (1937), with additional data, re-examined the question. His tables on pp. 239 and 243 give 50–60% of pregnancies among Blue whales examined at South Georgia and in two factory ships. On the face of it this would also indicate a two-year cycle, but he raises the difficulty that the majority of lactating females appear in the catches in the later part of the season. If a female spends the year following gestation first in lactation and then in resting we should expect a high proportion of lactating whales early in the summer. This is explained on the grounds that since breeding takes place in warmer waters, females accompanied by calves are much later in their southward migration than other whales, and do not reach the southern whaling grounds until the later part of the season. The fact that there is a substantial proportion of lactating whales as late as February and March, when the majority of births are believed to take place in April and May, might seem to imply that the suckling of the calf may last longer than the seven months roughly estimated by Mackintosh and Wheeler. The breeding season, however, is very protracted, and although it is possible that seven months is not a very accurate estimate of the period of lactation, there may well be sufficient late births to account for these late instances of lactation. Mothers who give birth at or before the normal time may, as Laurie suggests, find the southern waters too cold for their calves early in the season, or they may travel more slowly, so that lactation may be over by the time they reach the southern grounds. We have in fact little means of knowing what is the true proportion of lactating whales in the stock in the early summer months. Laurie's fig. 7 shows an increase in the percentage of resting whales from November onwards, and this is in accordance with expectation if there is a two-year breeding cycle, the supposition being that the summer stock in high latitudes, consisting at first of a high proportion of pregnant whales, becomes progressively diluted or displaced by whales which have recently finished lactation. Laurie points out that there is still a by no means negligible proportion of resting whales at the beginning of the season, and that there is reason to believe that these have stayed south all the winter. They would thus have missed a breeding season and would next become pregnant three years (instead of two) after their last pregnancy. This may well be correct, but I do not think it necessarily suggests that the normal interval between pregnancies is more than two years. Table 27 (p. 277) shows such high percentages of pregnant females on the pelagic whaling grounds, which it must be supposed harbour the bulk of the adult stock in the summer months, that even allowing for the absence of many non-breeding females in the early part of the season, it is difficult to believe that the interval between pregnancies is often more than two years. It should be possible to examine the evidence more fully when the data on ovaries have been properly analysed, but in the meantime it is necessary to point out that Table 27 is in certain respects misleading. A preliminary examination of the data indicates that the percentage of adult females which are pregnant has been increasing in a remarkable degree year by year, as if the actual rate of breeding were becoming faster. This curious phenomenon might alone be sufficient to account for the fact that in Table 27 there is a higher percentage of pregnant females in the pelagic catches in the period 1932–41 than at South Georgia in 1925–31. It could also account for the higher percentage of pregnant Fin than pregnant Blue whales in the pelagic catches, for the Fin whale data are nearly all from the two most recent seasons. At South Georgia, however, the percentage of pregnant Fin whales does seem in each year to be higher than the percentage of pregnant Blue whales. The additional data now available does not seem to suggest any revision of the original inference that most females become pregnant every two years, but it is evident that the whole question is more complex and difficult than at first appeared. No doubt the interval varies, and if the rate of breeding has increased in recent years, conceivably as a reaction to whaling, it would probably mean that fewer whales fail to become pregnant after two years from the last pregnancy. There is some evidence that the occurrence of whales simultaneously pregnant and lactating is also less rare than in former years.

Laurie points out that if we assume that a large proportion of non-breeding females are absent from the whaling grounds during part of the Antarctic summer, then we should expect to find males correspondingly more numerous than females, and suggests the possibility that these absent females are accompanied by a corresponding number of males. I have, however, re-examined Laurie's data for 1932–3 (when lactating females had not yet received protection), and find that in fact in the early part of the season there was a considerable excess of males, while towards the end, when the majority of lactating females made their appearance, there was an excess of females (see Table 25, p. 273).

GROWTH TO SEXUAL MATURITY

In the absence of direct evidence it is also difficult to be certain of the rate of growth from birth to sexual maturity. Mackintosh and Wheeler estimated that this period was two years, and the basis of the calculation was mainly the incidence of unweaned calves and the appearance of length groups in immature whales. Blue whales provided the best evidence. Records of the smallest whales of this species to be found in the British Museum's statistics of South African catches, when plotted according to the length and month in which they occurred, suggested that they more than doubled their length in the first seven months after birth, and since the baleen appeared to make a sharp increase in growth at about 16 m. it was inferred that weaning takes place at about this length. The appearance of two length groups in immature Blue whales measured at South Georgia suggested that the total period from birth to sexual maturity was two years; and the curve of linear growth so obtained, when compared with the estimated growth during the nursing period, indicated a slowing down of growth after weaning. This was admitted to be a rather speculative estimation, but such rapid growth agrees well enough with Andrews's estimation (1914) of the growth of the Grey whale (in so far as analogy with this species is significant) and with the observed growth of a young Fin whale recorded by Hjort (see Harmer, 1920, p. 77).

More recently, Rayner (1940), in his account of the results of whale marking by the Discovery Committee, describes the important example of a Fin whale which was marked in the Antarctic in February 1935. This whale he considers to have been not more than 40–45 ft. long (i.e. about 13 m.), and possibly less. It was at any rate a calf accompanied by its mother, and if our estimate of the rate of growth during lactation is anywhere near correct it must have been born in the normal breeding season of 1934. The whale was killed and the mark returned from South Africa on 1 July 1937, when it should be just about three years old. Its length was then given as 68 ft. 9 in., or 20·95 m. Table 8, p. 218, shows that this is well past the mean length at which sexual maturity is reached, and Wheeler's comparison (1930, p. 411) of the numbers of corpora lutea in physically mature and immature Fin whales shows that it is not impossible for a whale of this length even to have reached full physical maturity when growth ceases. There must at least be plenty of Fin whales which have been sexually mature for a year or more without exceeding this length. We can therefore say that this whale almost certainly grew from birth to sexual maturity in not more than three years and may quite well have done so in two. Had it been possible to secure the ovaries this point might have been settled.

The white scars, referred to on p. 214, are formed when whales are in warmer regions during the winter migration, and since they heal when a whale returns to the Antarctic a fresh batch should be added each winter if a whale undertakes regular annual migrations. Wheeler (1934, p. 363) shows that it is often possible to distinguish in young Fin whales separate sets of scars which appear to have been superimposed on one another. His analysis of the data suggests that if in fact these sets of scars are annual accretions, then some Fin whales should reach sexual maturity two years after birth and some three years after birth. He points out, however, that this inference rests on unsatisfactory evidence. We do not know very much of the circumstances in which the scars are formed, it is not certain that all young Fin whales undertake regular annual migrations, and we cannot be quite certain that what appear to be several age series of scars are really annual additions.

The position is that while the estimate of two years as the normal period from birth to sexual maturity is not proved, it is unlikely to be more than three years and may very likely be sometimes two and sometimes three in both Blue and Fin whales. Matthews (1937, 1938*c*) considers that Humpback and Sei whales begin breeding about two years after birth.

THE DETERMINATION OF AGE

It is not proposed to discuss here in much detail the estimation of the ages of whales because, as mentioned on p. 216, the war has left a considerable amount of unfinished work on the subject. Something may be said, however, of the general basis on which such estimations can be made.

There are five anatomical features which are correlated in one way or another with a whale's age: (i) length; (ii) sexual maturity, as indicated by the condition of the reproductive organs; (iii) physical maturity, as indicated by the condition of the vertebral epiphyses; (iv) the number of corpora lutea in the ovaries; (v) the number of old scars on the surface of the body.

Length is obviously an indication of age up to a point, but has no relation to age after physical maturity is reached.

Sexual and *physical maturity* are two successive stages in the development of the individual and form extremely useful landmarks with which to correlate other evidence on age. All individuals of a given species do not of course necessarily reach either of these stages at exactly the same age, but there is an inherent probability that they do so at about the same age. According to Marshall (1922, p. 714) domestic animals reach sexual maturity at fairly definite ages, but some variation may be caused by environment and nutrition, and complete sexual maturity is not reached all at once. These points no doubt apply also to whales, and our calculations must be concerned with the mean age at which maturity is reached. For reasons given on p. 221 physical maturity is also probably reached at a fairly definite age. This is when the epiphyses are fused with the centra throughout the vertebral column. Fusion takes place at first at the ends of the column, and the last vertebrae to be fused are the anterior thoracics (see Wheeler, 1930, pp. 407–9). Since plenty of whales are found in the intermediate stages this progressive fusion must take some time, and if the fusion is more advanced in one whale than in another we can say that the former is likely to be the older, even though both are sexually and neither is physically mature.

The number of corpora lutea forms the most important criterion of age that has so far been found. As explained above (p. 220) their value lies in the fact that they constitute a more or less permanent record of the number of ovulations which have taken place. The number of ovulations which can take place each year is limited, and since there is a close correlation between the number of corpora lutea and the attainment of physical maturity, these bodies come near to being a criterion of the absolute age of the whale.

The significance of the *old scars* on the skin is described on pp. 214 and 215. They are formed when the whale migrates to warmer waters, they appear to be permanent, and whales with many corpora lutea generally have a correspondingly large number of scars. It would scarcely be possible, however, to make reliable estimates of the numbers of scars on whales, or, except in the youngest whales, to distinguish the separate age series. Generally it can only be said that a whale with many scars is an old whale, or with few a young whale.

The most important problem is to ascertain how many corpora lutea on the average are added each year in a sexually mature female. If this can be done the mean period from sexual to physical maturity can be determined, and the average age of a number of females in which the ovaries have been examined can be estimated. Wheeler's figures (1930) indicated that physical maturity in Fin whales is reached when about fifteen corpora lutea have accumulated in the ovaries. He found three peaks in a graph of corpora lutea frequencies in physically immature whales, and inferred that Fin whales become physically mature at from four to six years after sexual maturity. Laurie (1937) found that physical maturity in Blue whales coincided with an accumulation of eleven to twelve corpora lutea. His frequency curves did not suggest that any particular numbers of corpora lutea consistently occurred more often than others, but he considered that certain of the old corpora lutea could be distinguished as of more recent origin than the rest, and attributed them to ovulations which had taken place during the last breeding season. From this he estimated that the average increment of corpora lutea after the first adult season is slightly more than one per annum, and he claimed some corroboration in a comparison of peaks in frequency curves for successive years. Wheeler and Laurie would not, I think, claim any final certainty of their calculated rates of accumulation of corpora lutea, and the estimations certainly need checking.

In an unpublished note on the growth and age of Blue and Fin whales which was submitted to the International Whaling Conference of 1939, Dr N. Peters considered that an old corpus luteum of pregnancy could be distinguished histologically from one formed from a corpus luteum of pseudo-pregnancy (i.e. of ovulation which has not been succeeded by impregnation). By counting the former and assuming a two-year reproductive cycle, he provisionally estimated that in the Blue whale there is an average of 1·9 and in the Fin whale an average of 1·8 ovulations in two years. This is not much different from Laurie's estimate for Blue whales.

Recently, a very important whale mark was returned to the Discovery Committee which had been carried by a whale for six years and which throws some light on the rate of accumulation of the corpora lutea. It was fortunately recovered in the factory ship 'Svend Foyn' in the season in which Mr P. R. Crimp was examining whales on board, and he was able to secure the ovaries. Particulars are as follows:

Mark no. 696. Fired: 11. xii. 34; 54° 45′ S, 34° 51′ W (off South Georgia).
Recovered: 26. ii. 41; 60° 15′ S, 54° 22′ W.
Whale: Fin, female, 23·2 m. (76 ft.), not pregnant.
Ovaries: 4 lb. 9 oz., with eight old corpora lutea.
Uterus: 16 cm. (collapsed diameter).
Mammary glands: 5 cm. thick, involuted.
Vertebrae: epiphyses unfused.
Scars: moderate number.

No note as to the whale's size was made at the time of marking, so there is no reason to suppose that it was then conspicuously immature. One cannot draw any final conclusions from the particulars of a single whale, but in this one, since it had only eight corpora lutea, the rate of accumulation cannot have been much more than about one a year (or two every two years), and, since there was no clue to the whale's age at the time of marking, the rate of accumulation may have been even slower. This is compatible with Peters's estimate for Fin whales but hardly with Wheeler's.

It may be that some definite conclusion as to the rate of accumulation will be reached when all the data on ovaries can be examined.

STATISTICS OF CATCHES

The statistics of the whaling industry provide essential information on the industry itself and on the stock of whales. Whaling factories of nearly all nationalities are required to keep records of the species, length, sex, date and place of capture of every whale taken, and, so far as possible, of the length and sex of any foetus present. Information is also supplied as to the number and tonnage of the ships employed and the production of oil and other commodities. The figures are tabulated and analysed by the Committee for Whaling Statistics appointed by the Norwegian Government on the recommendation of the International Council for the Exploration of the Sea. Since 1930 this Committee has published annually an analysis of the statistical data (those from the Antarctic and those from other regions now appearing as separate papers), and the result is a series of very valuable and informative documents.

Much of our knowledge of the stock of whales is based on the assumption that the catches recorded in these statistics are to a certain extent representative samples of the stock of whales. They are not of course wholly representative, since there is naturally some discrimination in the taking of whales of different species and different sizes, and in the intensity of fishing in different areas; but valid conclusions can be drawn as to the broad features of the distribution of different species, and of certain seasonal and annual changes in the local composition of the stock; and comparisons can be made between the whale populations of different localities. It is, however, necessary to use a good deal of caution. For example, changes from month to month in the catches of a factory ship may be due to movement to another part of the whaling grounds as well as to real changes in the population. Some of the inferences to be drawn must therefore be tentative. Some allowance must also be made for the fact that records such as the length of each whale and particulars of foetuses are made by men whose attention is first claimed by the work of the factory and who cannot be expected to make records with such consistent accuracy as an independent observer. Ottestad, for instance (1938, p. 51), has shown that there is a strong tendency to record measurements in round numbers, so that a length-frequency curve shows pronounced peaks at 70, 75, 80, 85 ft., etc. At the same time there is every reason to believe that in general these records are made conscientiously, and that the vast body of data that accrues from them may be regarded as sound for statistical purposes, though too much reliance should not be put on the particulars of individual whales. The occurrence of occasional clerical errors cannot altogether be ruled out in the records of the independent observer also, who works with soiled notebooks in the difficult conditions of the flensing platform.

SOUTHERN WHALING CENTRES

A concise account of the development of modern whaling is given by Risting in the second issue of the *International Whaling Statistics* (1931). Whaling with the harpoon gun began in European waters in 1868 and spread from the Norwegian coasts to Iceland, the Faroe Islands, the Shetlands and Hebrides, Spitzbergen, Newfoundland, and eventually to northern Pacific waters. Modern whaling in the southern hemisphere began in 1904 when the Cia Argentina de Pesca established their station at South Georgia. In the following season whaling was begun at the South Shetland Islands, and within a few years operations had started in the South Orkneys, Falkland Islands, Natal, Cape Province, Walvis Bay, Angola, Congo, Portuguese East Africa, Brazil, Chile, Australia, and Kerguelen Island. At these centres whaling was carried on with land stations or moored factory ships, but about 1923 the first experiments were made with cruising factory ships; successful whaling expeditions were made to the Ross Sea, and these were rapdily followed by the enormous expansion of pelagic whaling, as a result of which more whales are taken in the open seas of the Antarctic than in all other regions combined.

The progress of modern whaling in the southern hemisphere is further described in the fourth issue of the International Statistics (1933) and need not be reiterated here. Some figures must be quoted, however, so that the type of catch which characterizes the different centres may be compared. The positions or approximate spheres of operation are shown in Figs. 1 and 2, and in Table 9 these centres are listed roughly in order of latitude. Since the catching capacity (i.e. the number of factories and catchers, the efficiency of the plant, etc.) is very different in the different centres and varies also from year to year, the figures do not show much beyond the *relative* abundance of each species in each locality. The principal points to be noted are the overwhelming importance of South Georgia and the Antarctic as compared with other centres, and the fact that in the tropical localities, between the equator and about 25° S, the catch is composed almost entirely of Humpbacks, whereas in the colder regions there is more variety of species with Blue and Fin whales generally dominant. Particulars of the catches year by year are given in Table 10.

Table 9. *Southern whaling centres. Total catches recorded*, 1904–39

Whaling centre	Approximate latitude	No. of seasons	Right	Blue	Fin	Sei	Humpback	Sperm	Unspecified	Total
Congo	1° S	13	—	1	22	132	11,158	163	—	11,476
Brazil	7° S	4	—	—	—	—	1,113	2	—	1,115
Angola	12–17° S	14	17	1,106	358	947	10,027	245	2,298	14,998
East Africa	15–18° S	7	—	—	—	—	3,218	20	205	3,443
West Australia	21–26° S	12	—	14	9	2	15,995	300	470	16,790
Madagascar	25° S	2	—	5	24	10	2,975	48	—	3,062
Walvis Bay	23° S	11	—	1,781	374	7	584	40	543	3,329
Natal	30° S	31	28	2,918	9,104	1,095	6,081	10,136	1,985	31,347
Cape Province	33° S	24	25	7,027	7,202	2,636	324	1,653	4,346	23,213
Chile and Peru	0–50° S	26	97	2,364	2,559	191	1,726	8,039	1,004	15,980
Kerguelen Island	50° S	3	—	4	1	—	118	—	387	510
Falkland Islands	52° S	6	1	13	139	689	179	—	358	1,379
South Georgia	55° S	35	457	39,808	48,301	2,571	24,392	707	3,426	119,662
Antarctic	53–70° S	30	130	206,904	148,595	1,970	24,308	6,080	2,135	390,122
Total			755	261,945	216,688	10,250	102,198	27,433	17,157	636,426
Percentage			0·1	41·2	34·1	1·6	16·1	4·3	2·7	100·0

Statistics of catches from the east coast of Australia (35° S) and New Zealand (35–41° S) are not available (see p. 231).

I am indebted to Mr Harald Paulsen for much of the information in the following notes. They apply to the period ending with the outbreak of war, for I have no information on the activities of these centres in war time.

Congo. Whaling began in 1912 at Cape Lopez, and was continued to 1914 by factory ships. A land station and one or more factory ships worked from 1922 to 1926, and a land station in 1930. A land station reopened in 1934 and factory ships worked from 1935 to 1937. The catches consist almost entirely of Humpbacks, a few Sei whales being taken from time to time. (See *International Whaling Statistics*, no. II, p. 30, and no. XIII, p. 8.)

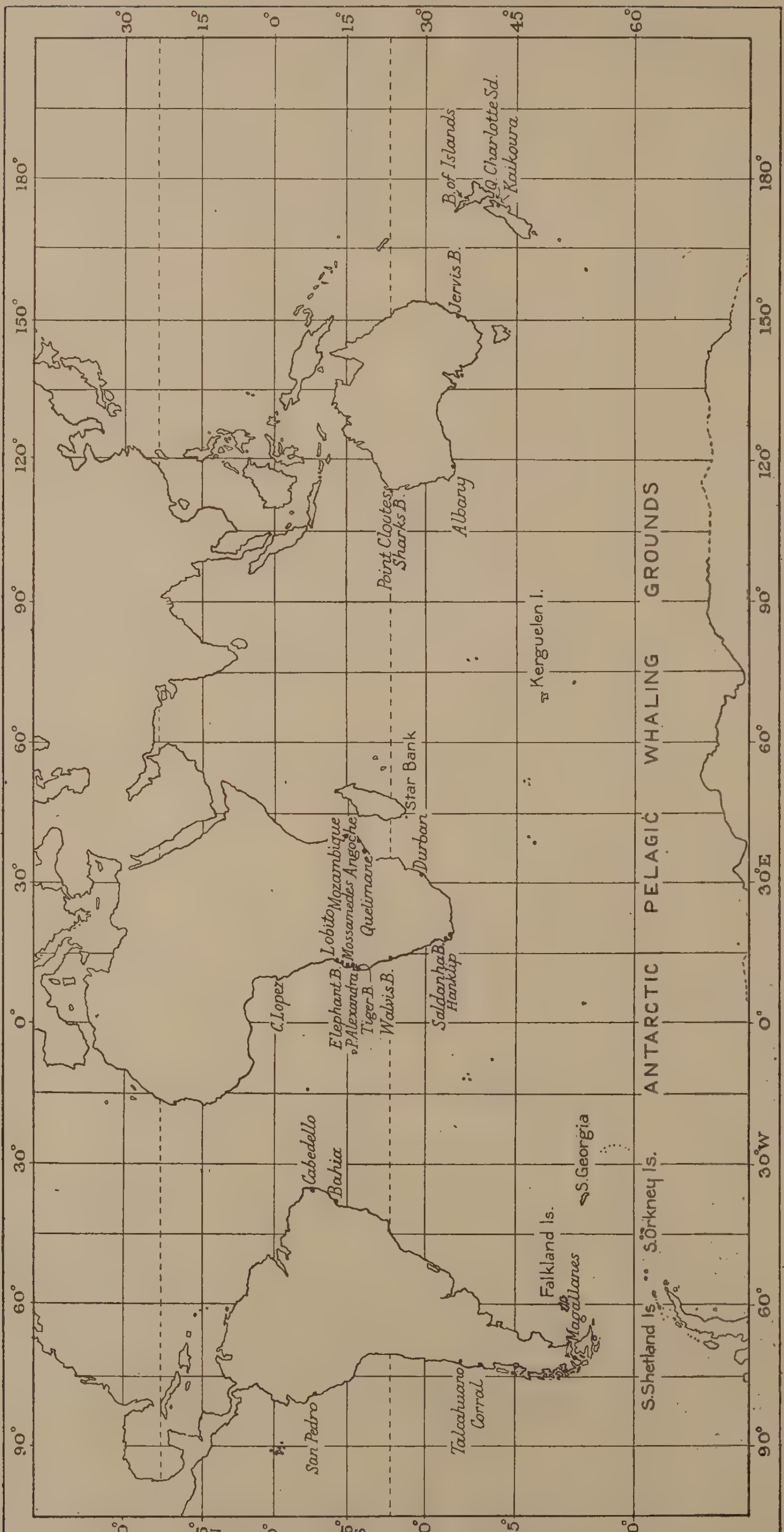
ANTARCTIC PELAGIC WHALING GROUNDS
B. of Islands
Q. Charlotte Sd.
Kaikoura
Jervis B.
Albany
Point Cloutes
Sharks B.
Kerguelen I.
Star Bank
Durban
Mozambique
Angoche
Quelimane
Lobito
Mossamedes
Elephant B.
P. Alexandra
Tiger B.
Walvis B.
Saldanha B.
Hanklip
C. Lopez
Cabedello
Bahia
S. Georgia
S. Orkney Is.
Falkland Is.
Magallanes
S. Shetland Is.
Talcahuano
Corral
San Pedro
30°
15°N
0°
15°S
30°
45°
60°
180°
150°
120°
90°
60°
30°E
0°
30°W
60°
90°

Fig. 1. Whaling centres in the southern hemisphere. See also Fig. 2.

Brazil. Whaling took place from 1910 to 1915. A land station was at work at Cabedello, north of Pernambuco, and in some years factory ships operated from Bahia. The land station also operated in 1916, 1917 and 1918. In those years for which returns are available almost nothing but Humpbacks was taken. (See *International Whaling Statistics*, no. II, p. 30.)

Angola. From 1910 to 1916 land stations and factory ships were at work and operations were based on Lobito Bay, Elephant Bay, Mossamedes, Port Alexandra, and Tiger Bay. In the six years 1923–8 whaling was conducted on a small scale at Elephant Bay from 1923 to 1925 and at Mossamedes from 1926 to 1928. No whaling appears to have taken place since then. In the earlier years the catch again consisted almost entirely of Humpbacks, but it is noteworthy that from 1923 to 1928 this species became very scarce in the catches, and the majority of whales taken were Blue, Fin and Sei. (See *International Whaling Statistics*, no. II, p. 30.)

East Africa. From 1910 to 1915 land stations and factory ships operated from Mozambique (Linga-Linga), Quelimane, and Angoche, and off the west coast of Madagascar in the Mozambique Channel. A land station also worked in 1923. The catches were almost exclusively Humpbacks. (See *International Whaling Statistics*, no. II, p. 28.)

West Australia. Whaling was begun at Sharks Bay in 1912, and in 1913 two factories worked at Norwegian Bay near Point Cloates. The statistics for these two years include some whales also taken on the east coast of Australia. From 1914 to 1916 operations were continued at Norwegian bay, and a land station worked at Albany in 1915 and a factory ship worked northwards from the same place in 1916. From 1925 to 1928 there was a shore station at Norwegian Bay, and in 1936 and 1937 two factory ships worked between 112–114° E and 21–24° S. In 1938 one factory ship worked in the same area. All the catches consisted almost entirely of Humpbacks. The International Statistics (no. II, p. 35) include 283 Sperm whales taken in 1912, but it appears that these were caught after the normal winter season by a factory which moved south to Frenchman's Bay and hunted Sperm whales during the ensuing summer (October to May). (See also *International Whaling Statistics*, no. XIII, p. 11.)

Madagascar. In 1937 and 1938 a factory ship worked off the south coast of Madagascar catching large numbers of Humpbacks and little else. This appears to have been at about 25° S, 44° E near the Star Bank. (See *International Whaling Statistics*, no. XIII, p. 8.)

New Zealand and East Australia. Modern whaling has been conducted only on a very small scale on the eastern side of Australia, and particulars of the catches are not given in the International Statistics. Ommanney (1933) describes the two small New Zealand stations at Whangamumu, Bay of Islands, and Tory Channel, Queen Charlotte Sound; Oliver (1922, p. 132) mentions another at Kaikoura, and Dakin (1934) mentions a little whaling carried on at Jervis Bay, New South Wales, in 1912 and 1913. These stations again are dependent on Humpbacks. In the years preceding the war of 1914–18 several factory ships visited east Australian waters but had no success, and Ommanney (p. 247) concludes that whales must be relatively scarce there.

Walvis Bay. From the International Statistics (no. II, p. 29) it appears that a land station worked here from 1912 to 1914 and from 1923 to 1930. The catches in 1912 and 1913 consisted mainly of Humpbacks, but in later years this species almost disappeared from the catches and Blue whales became predominant. A moderate number of Fin whales were also taken. Whaling at Walvis Bay was only on a small scale.

Natal. The whaling industries of Natal (at Durban) and Cape Province are the two most important in the southern hemisphere apart from the summer whaling in the Antarctic. Land stations at Natal, varying from one to six, have been in operation continuously from 1908 and the composition of the catches has on the whole been very consistent. In contrast to the tropical centres at which little is taken apart from Humpbacks, we find here that Blue, Fin, Humpback and Sperm whales all make a substantial contribution, and not a few Sei whales are also taken. The Sperm whales are mostly taken in the later part of the season. (See *International Whaling Statistics*, no. II, pp. 13, 28, and no. XIII, p. 8.)

Cape Province. Here also the whaling is conducted from land stations. Saldanha Bay is the principal centre, but a little whaling has also been done at Hangklip. Operations were continued from 1910 to 1930 and were resumed in 1936 and 1937. As at Natal the catches have varied little from year to year, though in 1936 and 1937 Blue whales were scarcer than before. Up to 1930 Blue and Fin whales were the predominant species, and Humpbacks and Sperm whales have always been scarcer than at Natal. Sei whales often figure largely in the catches. (See *International Whaling Statistics*, no. II, p. 29, and no. XIII, p. 8.)

Chile and Peru. This region is not so easily classified as the others, for the statistics include the catches of land stations at such places as Talcahuano, Corral and Magallanes as well as those of factory ships working from the equator to the southern parts of the Chilean coast, and separate returns from the different localities have not always been accessible. Mr Paulsen gives me the following particulars. A land station at Corral (province of Valdivia) worked from 1910 to 1930 and from 1935 to 1938. In 1912 there was also a land station at San Pedro; in 1935–8 there were land stations at Talcahuano and Magallanes. In 1910 and 1911 a factory ship worked off the southern part of the Chilean coast; in 1911 two more worked from San Pedro; in 1912 a factory ship worked from Corral and another from San Pedro; in 1914 two factory ships worked along the west coast as far north as Ecuador; in 1915 one worked off the south coast of Chile; and in 1935–8 factory ships operated off the coast of Peru apparently between 4° and 17° S and between 73° and 81° W. It seems clear that the factory ships working off the coast of Peru took large numbers of Sperm whales, and that the catches at Corral consisted on the average of roughly equal numbers of Blue, Fin, Humpback and Sperm whales. The catches at Corral are thus not unlike those at Durban. (See *International Whaling Statistics*, no. II, p. 34, and no. XIII, p. 10.)

The localities so far considered are those at which whaling takes place in coastal regions in the southern winter from about May to October.[1] We have now to compare the catches in higher latitudes where whaling is conducted in the southern summer.

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[1] It is not clear, however, whether the whaling off the coast of Chile is conducted in the winter months.

Kerguelen Island. Kerguelen Island and the Falklands are intermediate between the temperate regions of winter whaling and the great summer whaling grounds of the Antarctic. Operations appear, however, to have been conducted in the summer months. Very little whaling has been done at Kerguelen Island. The International Statistics (no. II, pp. 13, 27) give returns only for the season 1909–10 when Humpbacks accounted for 118 in a total catch of 123.

Falkland Islands. At New Island, West Falkland, a land station was at work from 1909–10 to 1914–15. The whaling was only on a small scale, but it is interesting to note that Sei whales were commoner than other species. A few Fins and Humpbacks were also taken. It is curious that the catches should be so different from those at Kerguelen.

South Georgia. So far as the relative abundance of the different species is concerned, South Georgia might be taken together with the rest of the Antarctic whaling grounds, but it is treated separately in the International Statistics, and it does differ in that the whales taken in its vicinity are generally on passage towards higher latitudes, or (sometimes perhaps in late summer) on their way north to warmer regions. At South Georgia whaling has been conducted continuously since the 1904–5 season, and for many years it was the most important centre in the world. In recent years, however, it has been overshadowed by the Antarctic pelagic industry, and the number of stations has been reduced from five or six to two. As to the catches it is enough at this stage to say that before 1912 the majority of whales taken were Humpbacks, and since that year Blue and Fin whales have been predominant. (See *International Whaling Statistics*, no. II, pp. 12 and 26, and no. XIV, p. 12.)

Antarctic. The figures under this heading in Table 10 include the catches of the factory ships moored at the South Shetland Islands and South Orkney Islands as well as those of the pelagic factory ships. It appears that whaling at the South Shetlands was conducted from 1905–6 to 1930–1. At the South Orkneys it began in 1911–12. The Statistics quote no figures for the period 1915–22, but catches are shown again from 1922–3 to 1928–9. It is not quite clear when whaling by moored factory ship ended at the South Orkneys, for after 1929 the catches there are not distinguished in the statistics from those of the pelagic fleet, but pelagic factory ships continued to work from time to time in the vicinity of these islands. Up to the season 1927–8 factory ships at the Shetlands and Orkneys accounted for the greater part of the catches shown in Table 10, but after that season these local centres were superseded by pelagic whaling. Although whaling began at the Shetlands in 1905–6 the figures for the first four seasons are not given in Table 10 because the statistics include whales taken from the Falkland Islands and South American coasts. It should also be noted that considerable numbers of Sei whales are listed in the seasons 1925–6 to 1928–9, and since this is a species not often found in high latitudes it may be that some of the whales included here and possibly in 1934–5 were also caught in more temperate regions, perhaps at the beginning or end of the season; but here the proportion of such whales is not likely to be very large. The

Table 10. *Yearly catches at southern whaling centres*

	Right	Blue	Fin	Sei	Hump-back	Sperm	Un-speci-fied
Congo							
1912	—	—	—	—	418	—	—
1913	—	—	—	—	2522*	—	—
1914	—	—	—	—	1760*	—	—
1922	—	—	—	1	613	—	—
1923	—	—	—	5	685	6	—
1924	—	—	—	3	394	—	—
1925	—	—	—	12	756	23	—
1926	—	—	—	45	321	35	—
1930	—	—	—	6	586	—	—
1934	—	1	21	27	724	45	—
1935	—	—	—	10	1241	—	—
1936	—	—	1	23	840	54	—
1937	—	—	—	—	298	—	—
Brazil							
1911	—	—	—	—	102	—	—
1912	—	—	—	—	342*	—	—
1913	—	—	—	—	352	2	—
1914	—	—	—	—	317	—	—
Angola							
1909	—	—	—	—	—	—	300
1910	—	2	1	—	718	—	—
1911	—	—	—	—	2289	—	—
1912	—	—	—	—	3125	—	—
1913	—	—	—	—	3432†	—	—
1914	—	173	68	—	350	15	873
1915	—	—	—	—	—	—	805
1916	—	—	—	—	—	—	320
1923	—	168	26	—	2	17	—
1924	—	75	17	274‡	47	17	—
1925	17	141	101	88	18	39	—
1926	—	303	40	33	6	14	—
1927	—	187	72	305	3	3	—
1928	—	57	33	247	37	140	—
East Africa							
1910	—	—	—	—	108	—	—
1911	—	—	—	—	537*	—	—
1912	—	—	—	—	1200*	—	—
1913	—	—	—	—	900*	—	—
1914	—	—	—	—	412*	—	—
1915	—	—	—	—	—	—	205
1923	—	—	—	—	61	20	—
Western Australia							
1912	—	1	—	2	592	283§	—
1913	—	2	—	—	1341	—	—
1914	—	2	1	—	1968	—	—
1915	—	—	—	—	1430*	—	—
1916	—	—	—	—	—	—	470
1925	—	—	—	—	669	—	—
1926	—	5	—	—	735	—	—
1927	—	3	—	—	996	—	—
1928	—	1	—	—	1033	—	—
1936	—	—	7	—	3072	14	—
1937	—	—	1	—	3242	3	—
1938	—	—	—	—	917	—	—

	Right	Blue	Fin	Sei	Hump-back	Sperm	Un-speci-fied
Madagascar							
1937	—	4	22	8	1223	—	—
1938	—	1	2	2	1752	48	—
Walvis Bay							
1912	—	—	—	—	—	—	192
1913	—	—	—	—	—	—	351
1914	—	46	3	—	94	—	—
1923	—	94	2	—	199	1	—
1924	—	155	7	—	77	—	—
1925	—	223	37	—	60	1	—
1926	—	226	44	—	96	9	—
1927	—	316	81	1	32	14	—
1928	—	262	38	—	10	—	—
1929	—	234	101	—	10	10	—
1930	—	225	61	6	6	5	—
Natal							
1908	—	—	—	—	—	—	106
1909	—	—	—	—	—	—	170
1910	—	—	—	—	—	—	532
1911	—	—	—	—	—	—	1051
1912	2	24	7	11	906	56	—
1913	3	59	263	1	662	230	126
1914	3	66	212	3	412	365	—
1915	1	79	285	7	122	486	—
1916	2	57	116	10	83	585	—
1917	—	36	60	5	7	68	—
1918	—	9	47	4	9	73	—
1919	2	12	145	3	91	388	—
1920	—	71	159	15	148	311	—
1921	3	123	246	49	190	294	—
1922	1	96	164	48	285	117	—
1923	—	213	330	60	122	84	—
1924	2	170	354	57	187	268	—
1925	—	240	254	112	167	511	—
1926	1	214	336	97	124	466	—
1927	1	220	287	89	84	408	—
1928	—	131	431	51	62	695	—
1929	—	177	637	42	99	842	—
1930	—	265	477	52	131	336	—
1931	—	122	466	29	71	135	—
1932	1	109	345	23	309	256	—
1933	2	85	602	11	162	306	—
1934	2	71	536	30	514	422	—
1935	2	122	526	90	418	595	—
1936	—	41	528	68	301	911	—
1937	—	67	755	64	240	503	—
1938		39	536	64	175	425	—
Cape Province							
1909	—	—	—	—	—	—	317
1910	—	—	—	—	—	—	170
1911	—	—	—	—	—	—	500*
1912	—	—	—	—	—	—	918*
1913	—	—	—	—	—	—	721*
1914	—	—	—	—	—	—	735
1915	—	—	—	—	—	—	775
1916	—	207	304	39	3	9	210
1917	—	337	342	35	7	25	—
1918	1	127	200	95	19	111	—
1919	2	108	219	190	14	108	—
1920	2	144	228	127	20	85	—
1921	2	125	139	34	30	28	—
1922‖	3	599	288	79	13	28	—

* Approximate figures.

† Includes some Sei whales.

‡ Includes thirty-two Bryde's whales.

§ Not apparently taken within the normal winter whaling season.

‖ Not reliable, the same figures being given for 1922 and 1923.

Table 10 (*cont.*)

	Right	Blue	Fin	Sei	Humpback	Sperm	Unspecified
Cape Province (*cont.*)							
1923*	3	599	288	79	13	28	—
1924	—	503	572	416†	19	35	—
1925	—	784	698	33	9	60	—
1926	1	1000	798	322†	19	95	—
1927	—	1020	761	93†	12	155	—
1928	3	554	436	402†	21	225	—
1929	—	316	411	222†	40	221	—
1930	1	468	554	164†	30	125	—
1936	—	79	566	221†	27	108	—
1937	7	57	398	85†	28	207	—
Chile and Peru							
1909	—	32	4	—	1	—	146
1910	—	—	—	—	—	—	254
1911	—	—	—	—	—	—	378
1912	—	185	10	—	86	55	—
1913	—	—	—	—	—	—	226
1914	—	179	47	4	671	21	—
1915	5	100	73	—	30	47	—
1916	2	64	35	—	15	15	—
1917	—	76	76	—	15	26	—
1918	3	68	70	—	23	31	—
1919	2	15	74	—	24	46	—
1920	—	54	24	—	21	21	—
1921	—	78	19	—	21	63	—
1922	—	85	21	—	19	77	—
1924	7	48	116	—	34	52	—
1925	7	112	233	13	248	61	—
1926	9	444	656	32	277	80	—
1927	—	199	294	—	22	156	—
1928	1	48	126	—	36	123	—
1929	9	139	113	—	26	99	—
1930	1	85	70	—	33	86	—
1931	—	43	6	—	53	43	—
1935	36	40	71	85	29	173	—
1936	1	174	235	10	18	2109	—
1937	—	81	130	3	18	3888	—
1938	14	15	56	44	6	767	—
Kerguelen Island							
1908–9	—	—	—	—	—	—	300
1909–10	—	4	1	—	118	—	—
1910–11	—	—	—	—	—	—	87
Falkland Islands							
1909–10	—	8	15	346	94	—	—
1910–11	—	2	25	195	70	—	—
1911–12	—	—	—	—	—	—	103
1912–13	—	—	36	43	8	—	—
1913–14	1	3	63	105	7	—	—
1914–15	—	—	—	—	—	—	255
South Georgia							
1904–5	—	11	4	—	180	—	—
1905–6	16	27	68	—	288	—	—
1906–7	8	20	53	—	240	—	—
1907–8	93	4	4	—	1281	—	—
1908–9	68	10	20	—	1841	1	—
South Georgia (*cont.*)							
1909–10	37	26	58	—	3391	4	—
1910–11	79	85	168	—	6197	—	—
1911–12	19	236	393	—	4247	3	1637
1912–13	—	233	1749	—	1916	3	949
1913–14	21	665	1316	86	405	16	840
1914–15	20	2313	1940	—	823	1	—
1915–16	12	3026	2744	—	1578	1	—
1916–17	12	2440	1606	—	378	35	—
1917–18	35	1871	1144	49	60	37	—
1918–19	9	1160	1530	7	68	18	—
1919–20	14	987	1673	71	79	8	—
1920–21	13	856	2643	36	103	31	—
1921–22	—	2570	710	103	9	3	—
1922–23	—	3569	1445	10	320	19	—
1923–24	—	1927	1378	191	130	49	—
1924–25	—	3512	2019	1	262	24	—
1925–26	—	1855	5709	13	236	12	—
1926–27	—	3689	1144	365	—	17	—
1927–28	—	2125	1357	95	—	60	—
1928–29	—	1560	3130	396	15	31	—
1929–30	—	488	3396	216	46	39	—
1930–31	1	1085	1416	144	66	24	—
1931–32	—	438	1735	16	6	10	—
1932–33	—	267	727	2	—	—	—
1933–34	—	536	1728	—	92	7	—
1934–35	—	556	836	125	37	21	—
1935–36	—	1221	520	—	41	3	—
1936–37	—	121	1079	471	17	70	—
1937–38	—	97	1552	155	40	43	—
1938–39	—	232	1307	19	—	117	—
Antarctic							
1909–10	20	138	358	—	1481	—	—
1910–11	21	306	487	—	2027	—	481
1911–12	9	873	1287	—	1508	—	1409
1912–13	3	1960	2742	—	1114	—	—
1913–14	5	1666	2817	—	1147	—	245
1914–15	2	1890	1954	—	666	—	—
1915–16	5	1845	2358	—	219	4	—
1916–17	—	1380	602	—	21	—	—
1917–18	13	397	627	—	71	—	—
1918–19	11	641	1261	1	81	—	—
1919–20	—	887	1540	—	182	—	—
1920–21	—	1761	2848	—	157	—	—
1921–22	—	1846	1782	—	—	—	—
1922–23	—	2114	2232	—	197	4	—
1923–24	12	1805	1657	2	103	17	—
1924–25	—	2191	2347	—	97	35	—
1925–26	10	2842	3207	182	128	25	—
1926–27	12	2856	3958	413	189	22	—
1927–28	4	6209	3102	788	23	12	—
1928–29	—	11174	3559	412	33	31	—
1929–30	—	16999	8143	—	806	34	—
1930–31	1	28325	8601	1	510	27	—
1931–32	—	6050	1136	—	178	3	—
1932–33	—	18624	4441	—	159	107	—
1933–34	—	16813	5472	—	780	659	—
1934–35	—	15944	11664	141	1928	556	—
1935–36	—	16510	9177	2	3121	396	—
1936–37	1	14183	13302	19	4460	856	—
1937–38	—	14826	26457	6	2039	824	—
1938–39	1	13849	19477	3	883	2468	—

* Not reliable, the same figures being given for 1922 and 1923.

† Including some Bryde's whales.

different species appear in the Antarctic catches in much the same proportions as at South Georgia. Blue and Fin whales are the most important and Humpbacks have at times been taken also in considerable numbers. (See *International Whaling Statistics*, no. II, pp. 12 and 26–7, and no. XIV, p. 5.)

The southern whaling centres described above may now be usefully classified as follows:

(1) *Winter whaling*

(*a*) Tropical localities in which the industry is dependent almost entirely on Humpbacks in coastal waters: Congo, Brazil, Angola, East Africa, West Australia and Madagascar.

(*b*) Subtropical or warm temperate localities in which several species are of importance in the catches: Walvis Bay, Natal, Cape Province, and Chile[1] and Peru.

(2) *Summer whaling*

(*a*) Temperate or sub-Antarctic localities at which whaling has been conducted only on a small scale: Kerguelen and Falkland Islands.

(*b*) Antarctic waters[2] in which the catches consist mainly of Blue and Fin whales but have at times included also substantial numbers of Humpbacks: South Georgia and the Antarctic pelagic whaling grounds.

It is uncertain whether the stations at Jervis Bay and New Zealand should be included in the tropical or subtropical category. They were Humpback fisheries but rather south of the characteristic tropical coastal resorts of this species in winter, and it is doubtful whether such small catches are fully representative of the local whale population.

This classification is of assistance in a study of the distribution of whales and of the effect of whaling on the stock.

MIGRATIONS AND DISTRIBUTION

Certain broad features of the distribution of whales in the southern hemisphere may be gathered from a comparison of the catches in different whaling centres. Thus it is obvious from Table 9, p. 229, that Blue, Fin and Humpback whales are to be found in large numbers in the Antarctic in the southern summer, that all three species frequent temperate regions in the southern winter, but that Blue and Fin whales are much scarcer than Humpbacks in the tropics, at any rate in coastal regions. Sei whales are common enough in temperate regions in winter, but in summer they do not venture so far south as the other species.

In summer Blue and Fin whales are distributed in a more or less continuous circumpolar belt in the Southern Ocean. This is a matter of common experience, and is evident in the Discovery Committee's records of whales identified at sea, though, as will be seen, the abundance of these species may vary in different sectors. Hansen's *Atlas over Antarktis og Sydishavet* (1936) shows the positions in which whales were taken by the pelagic fleet between 1929 and 1934, and gives a striking impression of the zone in which whales are found. It gives no indication of course of the distribution of whales in the Pacific sector, since whaling has not been conducted there. Humpbacks can also be said to have a circumpolar distribution, but this distribution is less continuous, for they have a tendency to concentration in some regions and scarcity in others which is more marked than in Blue and Fin whales. There is less information about Sei whales. Table 9 shows that they appear in the catches of South American, African and Australian stations, and the species is no doubt circumpolar, but it is possible that, like the Humpback, it occurs more commonly between some meridians than between others.

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[1] See footnote, p. 232.

[2] I.e. not necessarily within the Antarctic circle but south of the Antarctic convergence which marks the northern boundary of the Antarctic surface water (see Fig. 2 and Deacon, 1937, p. 22).

The edge of the pack-ice constitutes the approximate southern limit of distribution of Blue, Fin and Humpback whales, but it is doubtful whether Sei whales ever penetrate into such cold water.

The distribution of whales naturally cannot be understood without information on their movements and migrations, for whales are constantly on the move and travel over great distances. Some distinction has to be made between migration and local movements. The term 'migration' is used here to imply long annual journeys between the Antarctic and temperate or tropical waters, but there is not always a very clear distinction between such journeys and certain regular local movements such as Rayner (1940) has described.

The evidence for believing that whales undertake regular annual migrations is partly direct and partly indirect. Almost the only direct evidence is furnished by the marking of whales (see Rayner), but before the results of that work became apparent there was plenty of circumstantial evidence of migration. For Humpbacks in particular the evidence is very clear; the routes of their migrations lie within comparatively narrow limits, especially in tropical coastal waters, and can thus be more easily traced than in the other species. For Blue and Fin whales direct evidence is slight, but there are various items of indirect evidence which collectively are very convincing.

HUMPBACKS

Since our ideas of the habits of other species are assisted by our better knowledge of the habits (or at least the migrations) of Humpbacks, it will be better to take the latter species first and to consider in full the major features of its distribution and migrations.

Various writers have shown how the migrations of this species are indicated by the statistics of catches at different times and places. It is to be found in summer in Antarctic waters and in winter in tropical regions, and its movements up and down the African and Australian coasts can be followed by direct observation. A good survey of the subject is given by Matthews (1937) who refers to publications by Risting (1912), Olsen (1914–15), Lillie (1915), Hinton (1925), Harmer (1931), Dakin (1934) and Townsend (1935). It is evident that the main herds of migrating Humpbacks penetrate far into tropical waters. At Natal they are taken early in the winter on their way north and later in the season on their return south. On the west side of South Africa the northward-moving Humpbacks approach the coast north of Saldanha Bay and follow it up towards the equator; hence the comparative scarcity of this species in the Saldanha Bay catches and their plentiful occurrence farther north at such centres as Angola and the Congo (see Table 9, p. 229). On this coast some of them pass north of the equator so that an interchange of stock between the southern and northern hemispheres seems by no means impossible. Regular northward and southward movements in winter are known off the coasts of Australia, New Zealand and South America, and in summer, when they have left these regions, they appear in comparable numbers in the Antarctic catches. On these facts alone there could hardly be any doubt of the existence of a seasonal migration between the Antarctic and the tropics, and the results of the Discovery Committee's programme of whale marking puts the matter beyond dispute. Rayner (1940) shows that a considerable number of marks fired into Humpbacks in the summer season on the Antarctic pelagic whaling grounds between 80 and 110° E have been recovered in winter off the West Australian coasts in about 24° S after intervals of $\frac{1}{2}$, $1\frac{1}{2}$, $2\frac{1}{2}$, etc., years. Others have been recovered in the following or subsequent summers near the place where they were marked. Marks fired in another part of the Antarctic have been recovered from the coast of Madagascar.

It is known also that pairing and parturition take place in winter when the Humpbacks are in tropical or temperate waters, and it has been shown (pp. 209–13) that those taken in the Antarctic in summer are nearly always feeding heavily, while those taken in warmer regions in winter eat little or nothing unless they can now and then find a meal of fish. There is no doubt then that Humpbacks undertake regular migrations to the Antarctic in summer where they find plenty of food, and to the coastal waters of the southern continents in winter where breeding takes place but where food must be relatively scarce. It is to be supposed that the vast majority of the Humpbacks take part in the migration, but as Matthews has pointed out, some remain in high latitudes over the winter, for they have been taken at South Georgia, when winter whaling was carried on there to some extent up to 1917–18, and it is possible that some, especially the immature whales, remain in the warmer latitudes over the summer.

The winter concentration along the continental coasts suggests that comparatively few Humpbacks, and possibly none at all, wander about the open spaces of the Atlantic, Indian and Pacific Oceans during their northward migrations. It also implies a division of the Humpback stocks, at least in winter, into certain major groups. It has been shown above that the species occurs, or has occurred, in sufficient numbers to support, or at least contribute to, local whaling industries off (*a*) the west coast of South America, (*b*) the coast of Brazil, (*c*) the west coast of Africa, (*d*) the east coast of Africa and Madagascar, (*e*) the west coast of Australia, and (*f*) New Zealand and the east coast of Australia. (Statistics of the catches in all except the last of these places are given in Table 10, p. 234, and accounts of the fisheries at the last are given by Ommanney (1933) and Dakin (1934).) In short, this species resorts to both sides of each of the three southern continents.

These features of the winter grouping are of course well known, but it is not so well known that there is also a grouping of Humpbacks in the Antarctic in summer. This is of

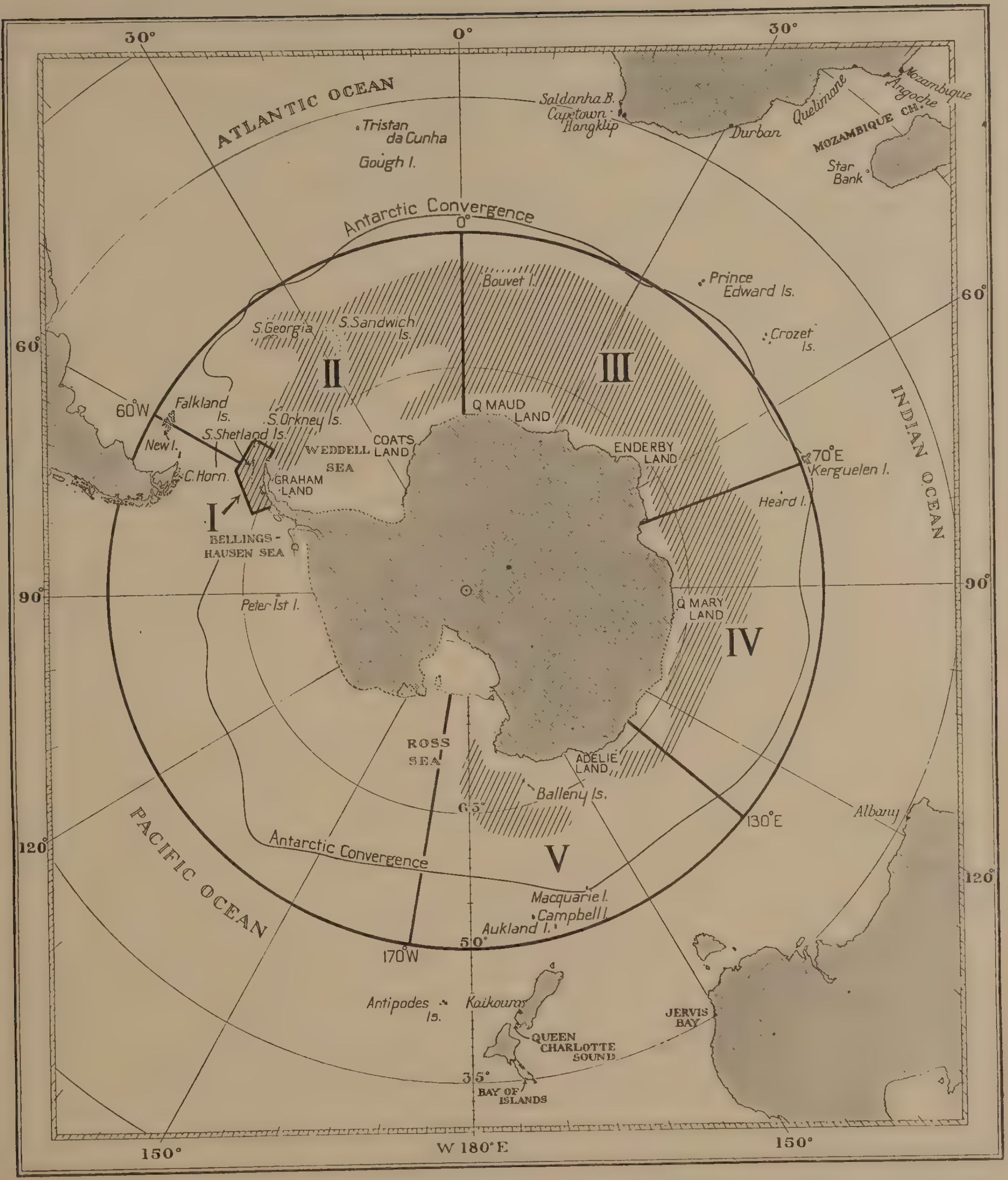
30°
0°
30°
ATLANTIC OCEAN
Tristan da Cunha
Gough I.
Saldanha B.
Capetown
Hangklip
Durban
Quelimane
Angoche
Mozambique
MOZAMBIQUE CH.
Star Bank
Antarctic Convergence
0°
Bouvet I.
Prince Edward Is.
Crozet Is.
60°
60°
S.Georgia
S.Sandwich Is.
II
III
INDIAN OCEAN
60°W
Falkland Is.
S.Orkney Is.
Q MAUD LAND
S.Shetland Is.
COATS LAND
WEDDELL SEA
ENDERBY LAND
70°E
Kerguelen I.
New I.
C.Horn.
GRAHAM LAND
Heard I.
I
BELLINGS-HAUSEN SEA
90°
90°
Peter Ist I.
Q MARY LAND
IV
ROSS SEA
ADELIE LAND
Balleny Is.
130°E
Albany
65°
PACIFIC OCEAN
120°
120°
Antarctic Convergence
V
Macquarie I.
Campbell I.
Aukland I.
50°
170W
Antipodes Is.
Kaikoura
JERVIS BAY
QUEEN CHARLOTTE SOUND
35°
BAY OF ISLANDS
150°
W 180°E
150°

Fig. 2. The Antarctic whaling grounds, showing Hjort, Lie and Ruud's areas I–V. The hatched area shows the actual whaling grounds and represents the approximate limits of regions covered in various months by factory ships as shown in Hansen's *Atlas* (1936) and Hjort, Lie and Ruud's charts, and by catchers based on South Georgia and the South Shetland Islands as shown by Kemp and Bennett (1932). The Antarctic convergence is from Deacon (1937).

much importance, for it can be shown that the winter and summer groups are largely one and the same.

The existence of distinct groups of Humpbacks in the Antarctic can be established by the movements of factories and statistics of catches, by the whale-marking records of the 'William Scoresby', and to some extent by the records of whales observed during voyages of the 'Discovery II'.

In their series of articles on 'Pelagic Whaling in the Antarctic', Hjort, Lie and Ruud, and latterly Bergersen, Lie and Ruud, divided the Antarctic whaling grounds south of 50° S into five main areas (see Fig. 2) as follows:

I. A small area around the South Shetland Islands.

II. 60° W to 0°, mainly the Weddell Sea and waters of the Falkland Islands Dependencies.

III. 0–70° E, from Bouvet Island to Kerguelen Island mainly to the south of South Africa.

IV. 70–130° E, from Kerguelen to West Australian longitudes.

V. 130° E to 170° W, south of New Zealand and including the Ross Sea.

Area I was defined merely to provide for the restricted operations of factory ships moored in harbours of the South Shetlands and is now of little importance. The limits of the other four areas were based on the distribution of the whaling fleet, and these authors showed that the factory ships always form a separate concentration in each area, except that area V has not been worked in recent years. Since the factories naturally go where they expect to find plenty of whales, it is inferred that the whales tend to form separate concentrations in each of the four areas. This will be referred to in more detail in connexion with the distribution of Blue and Fin whales, which are of course the species which influence the movements of the whaling fleet. In the meantime some more precise evidence on the distribution of Humpbacks is to be found in some catch statistics given in the same series of publications. The whaling grounds are further subdivided into squares measuring 10° of latitude and longitude, and tables are given showing the number of whales of each species caught in each month in each square. In the earlier articles the distribution of only Blue and Fin whales is given, but articles VII (table I, pp. 31–4) and VIII (table I, pp. 30–3) give separate figures for Blue, Fin, Humpback, and 'other' whales. These two latter articles deal with the seasons 1936–7 and 1937–8, when large numbers of Humpbacks were taken.[1] Table 11 here is a further analysis of those published in articles VII and VIII. For each 10° of longitude I have added together all the whales taken south of 50° S (i.e. making no distinction between those in 50–60° and those in 60–70° S). All three species are included because it is necessary to show that large catches of Humpbacks in any particular region are not simply due to scarcity of the other species. 'Factories' days' means the total number of effective working days spent by the factories in the region in question. In Hjort, Lie and

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[1] The catching of Humpbacks by factory ships in the Antarctic was prohibited by International Agreement in 1938.

Table 11. *Whales caught south of 50° S in 1936–7 and 1937–8*

	Area II						Area III							Area IV					
	Degrees west																		Degrees east
	60–50	50–40	40–30	30–20	20–10	10–0	0–10	10–20	20–30	30–40	40–50	50–60	60–70	70–80	80–90	90–100	100–110	110–120	120–130
Factories' days	155	380	335	280	214	240	535	394	661	325	85	21	34	106	405	343	379	286	69
Blue																			
Whales caught	486	754	1191	1003	984	1232	2544	1701	3170	2377	643	62	116	736	2842	2074	2635	1419	299
Whales per day	3·14	1·98	3·56	3·58	4·60	5·13	4·76	4·32	4·80	7·31	7·56	2·95	3·41	6·94	7·02	6·05	6·95	4·96	4·33
Fin																			
Whales caught	1314	5275	2888	2269	1253	1496	3752	2663	4041	1358	492	116	108	391	852	1136	2076	3253	930
Whales per day	8·48	13·88	8·62	8·10	5·86	6·23	7·01	6·76	6·11	4·18	5·79	5·52	3·18	3·69	2·10	3·31	5·48	11·37	13·48
Humpback																			
Wales caught	1	5	32	148	108	74	205	701	2221	439	16	1	2	65	898	857	283	127	54
Whales per day	0·01	0·01	0·10	0·53	0·50	0·31	0·38	1·78	3·36	1·35	0·19	0·05	0·06	0·61	2·22	2·50	0·75	0·44	0·78
Blue + Fin + Humpback																			
Total caught	1801	6034	4111	3420	2345	2802	6501	5065	9432	4174	1151	179	226	1192	4592	4067	4994	4799	1283
Total per day	11·62	15·88	12·27	12·21	10·96	11·67	12·15	12·86	14·27	12·84	13·54	8·52	6·65	11·24	11·34	11·86	13·18	16·78	18·59

Table 12. *Whales shot at by the 'William Scoresby' while marking south of 50° S, 1934–8*

				Area II						Area III							Area IV			
	Degrees west																			Degrees east
	90–80	80–70	70–60	60–50	50–40	40–30	30–20	20–10	10–0	0–10	10–20	20–30	30–40	40–50	50–60	60–70	70–80	80–90	90–100	100–110
Days at sea	4	9	12	15	12	23	20	11	11	23	29	62	30	45	31	12	11	35	31	4
Blue																				
No. of whales	1	19	—	—	2	2	18	2	10	33	54	178	101	117	37	4	17	122	130	8
Whales per day	0·25	2·11	0·0	0·0	0·17	0·09	0·90	0·18	0·90	1·43	1·86	2·87	3·37	2·60	1·19	0·33	1·55	3·49	4·19	2·00
Fin																				
No. of whales	—	190	139	127	208	201	169	80	117	216	190	859	199	429	298	61	43	50	130	23
Whales per day	0·0	21·11	11·58	8·47	17·33	8·74	8·45	7·27	10·64	9·39	6·55	13·85	6·63	9·53	9·61	5·03	3·91	1·43	4·19	5·75
Humpback																				
No. of whales	—	62	5	—	—	1	12	3	7	3	17	93	48	7	4	—	4	233	420	5
Whales per day	0·0	6·89	0·42	0·0	0·0	0·04	0·60	0·27	0·64	0·13	0·59	1·50	1·60	0·16	0·13	0·0	0·36	6·66	13·55	1·25
Blue + Fin + Humpback																				
Total whales	1	271	144	127	210	204	199	85	134	252	261	1130	348	553	339	65	64	405	680	36
Total per day	0·25	30·11	12·00	8·47	17·50	8·87	9·95	7·73	12·18	10·96	9·00	18·23	11·60	12·29	10·94	5·42	5·82	11·57	21·94	9·00

Ruud's table I it is called 'number of days with catch'. The totals for the two seasons are divided by the factories' days to give 'whales per day'. The upper part of Fig. 3 shows the Humpbacks killed per day, and indicates also the catches of the three species combined. Since Humpbacks are caught in considerably smaller numbers than the other two, the vertical scale for this species is doubled so that its relative distribution can be more easily compared.

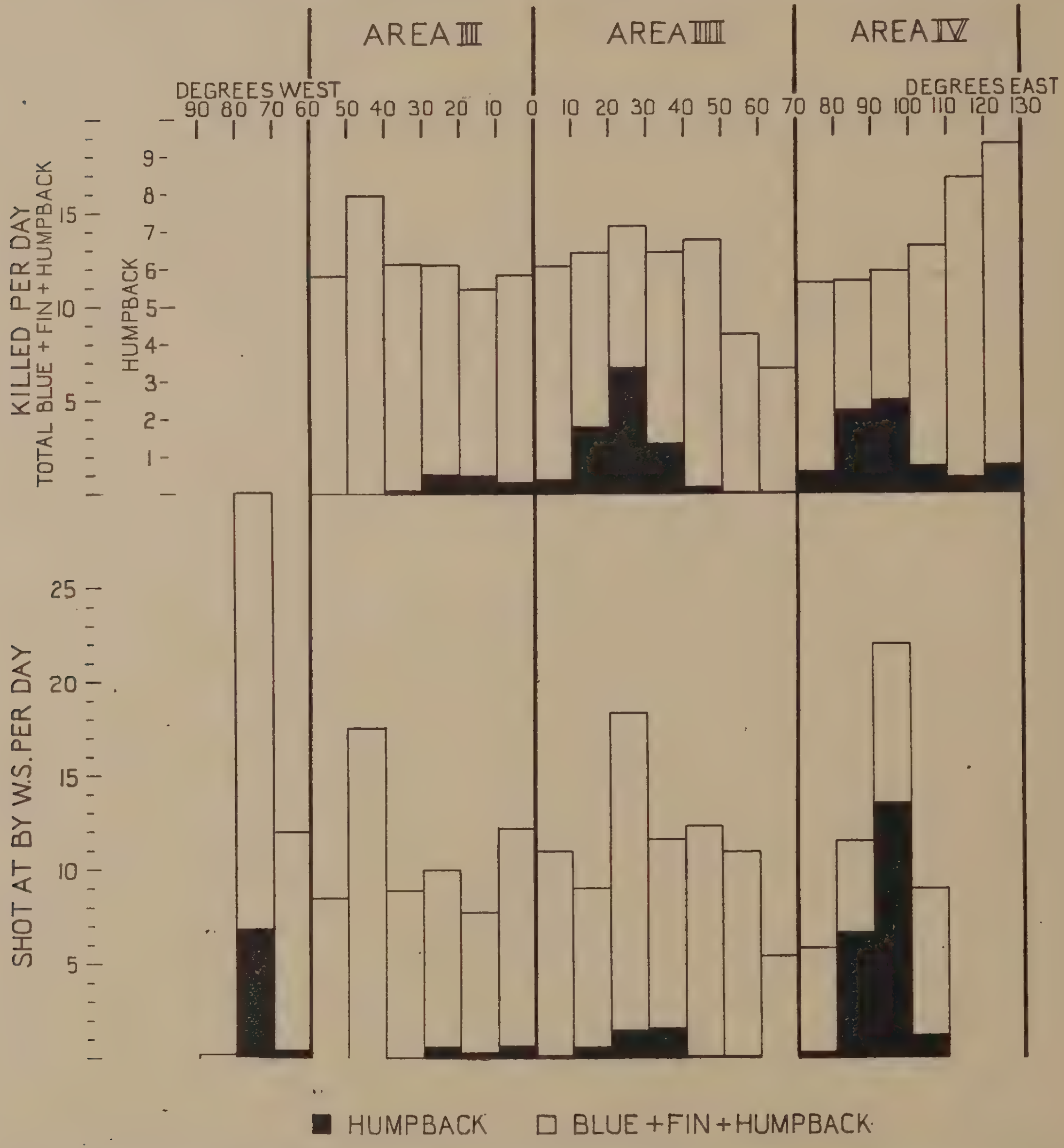


Fig. 3. Comparison, in every 10° of longitude, between Humpbacks killed per day in 1936–8 and Humpbacks shot at per day during the 'William Scoresby's' whale-marking cruises in 1934–8. From Tables 11 and 12.

It is clear that the vast majority of Humpbacks were found between 10 and 40° E and between 80 and 100° E. They are almost completely absent between 50 and 70° E. Between 10 and 30° W there is a very slight indication of increased catches, and this will be referred to again later. Since we have allowed for the time spent by the factories in each locality, and since in these regions there was no scarcity of other species, it must be that there was in those two seasons a real concentration of Humpbacks between 10 and 40° E and between 80 and 100° E. These are the only two seasons for which the necessary catch statistics are available, but it can hardly be doubted that there is a permanent summer concentration of Humpbacks at these points, especially as the phenomenon is amply confirmed by the marking records of the 'William Scoresby' which are spread over four seasons.

The various whale-marking voyages of the 'William Scoresby' are described by Rayner (1940, pp. 250–4). The ship spent four whaling seasons (1934–8) on the pelagic grounds. The first three covered the area between the Greenwich meridian and 105° E, and the fourth the western grounds between 10° E and 90° W, including the waters of the Falkland Islands Dependencies and the Bellingshausen Sea. The data are thus distributed over much the same range as those in Table 11 but extend a little farther west and not quite so far east. In these voyages it is the practice to cruise over wide areas and mark whales wherever they may be found. The records of whales marked or shot at should therefore be an indication of the whales' distribution. Table 12 is drawn up on the same lines as Table 11. The marking log books give the date, species and position of every whale at which a mark was fired, whether hit or missed. Table 12 analyses the whales shot at. Although a good many whales were shot at more than once a fair number were also marked more than once, and the general results would be much the same whether we go by whales shot at or only whales hit. 'Marking days' are derived from the ship's log and represent only the approximate number of days spent in searching for whales. To express the number of whales shot at as an accurate function of the time spent in searching for them full allowance should be made for weather conditions, but this would involve a laborious calculation of 'marking hours'; the corrections to 'marking days' would be trivial and would not affect the conclusions to be drawn. The table includes whales shot at anywhere south of 40° S, but there were very few between 40 and 50° S, and although the ship's tracks were if anything a little to the north of most of the factory ships' tracks they were within the zone occupied by the main concentrations of whales, and the ground covered is much the same.

Table 12 and the lower part of Fig. 3 quite obviously confirm the existence of concentrations of Humpbacks in the same two regions. The group in 80–100° E is much more strongly represented than that in 10–40° E, but the latter is clearly there, and again the species is almost completely absent between 50 and 70° E. Westwards beyond the range covered by the factory ships, there is another obvious concentration. This is between 70 and 80° W in the Bellingshausen Sea.

Three major concentrations of Humpbacks are now clearly demonstrated: one between 80 and 100° E which is not far from the longitude of Western Australia, one between 10 and 40° E lying to the south of South Africa, and one in the Bellingshausen Sea, south of the west coast of South America. The existence of the first two groups is further confirmed by Hansen's *Atlas over Antarktis og Sydishavet* (1936), which shows on a series of maps the approximate positions in which whales of the three species were taken in the seasons 1929–30, 1930–1, 1932–3, 1933–4 and 1934–5. In the two former seasons some factories worked as far east as the Ross Sea and Balleny Islands, i.e. in area V, Fig. 2, and it is quite evident from Hansen's atlas that they found there a fourth concentration of Humpbacks, that is to say to the south of New Zealand and the east coast of Australia. Whale marking by the 'William Scoresby' has not extended to this region, but confirmation of a concentration here is to be found in the records of whales seen during the voyages of the 'Discovery II'. Unfortunately, the number of Humpbacks which could be identified with any confidence is very much smaller than the number of Blue and Fin whales and quite inadequate for treatment on the lines of Tables 11 and 12. However, out of about sixty identifications of Humpbacks spread around the Southern Ocean, it happens that more than half were between 150 and 170° E, that is, in a region centred around the Balleny Islands. This is no indication that there is really a bigger concentration here than in the other groups, but it is worth mentioning as corroborative evidence of the existence of such a concentration.

In former years very large numbers of Humpbacks were taken at South Georgia (see Table 10, p. 235). The peak was reached in 1910–11 when over 6000 were killed. Thereafter there was a heavy decline which is at least in part attributable to excessive hunting (see Matthews, 1937, pp. 82–5). As was noted above, Fig. 3 suggests that there are still traces of a group between 10 and 30° W, and this no doubt is the remnant of a formerly important group which was presumably centred somewhere on the eastern side of the Scotia Sea. It is not quite certain whether this group was distinct from that in 70–80° W, but since the latter is still so sharply defined in the whale-marking records of the 'William Scoresby' it is highly probable that there were in fact two distinct groups.

The Antarctic Humpback stocks thus group themselves in the Bellingshausen Sea, in the south-west Atlantic sector, to the south of South Africa, to the south-south-west of Western Australia and to the south of New Zealand, one group falling neatly into each of Hjort, Lie and Ruud's areas II–V. It is not merely a majority tendency, for hardly any seem to occur in the gaps between. The positions of these groups would alone suggest that they were related to the winter concentrations along the coasts of the continents, and recoveries of whale marks have clearly shown that the groups centred between 80 and 100° E and between 10 and 40° E are in fact connected with the Humpbacks found off West Australia and Madagascar respectively. Rayner (1940) shows that thirty-six marks were recovered from Humpbacks, all of which were fired in Antarctic waters and returned after intervals varying from a few days to $3\frac{1}{2}$ years. For full details reference should be made to his report, but the essential facts are given in the condensed data in Table 13. This shows that thirty recovered marks were fired in the group which we now know to be concentrated about 80–100° E, and the one in 75° E doubtless belongs to the same group. Three were fired in the group south of South Africa, and the one in 54° E was nearer to that concentration than to the 80–100° E group. One was fired in the depleted South-West Atlantic group.

Table 13. *Marks recovered from Humpbacks*

Marking positions	Area	No. marked and subsequently recovered	Position of recoveries
85–102° E	IV	30	9 from the same locality, 21 from North-West Australia
ca. 75° E	IV	1	From North-West Australia
ca. 54° E	III	1	From Madagascar
10–35° E	III	3	2 from the same locality, 1 from Madagascar
Off South Georgia	II	1	From the same locality

The list of recoveries clearly shows that the 80–100° E group is made up of the same whales as those which appear in winter off the coast of Western Australia, and the two recoveries from Madagascar leave little doubt that the Humpbacks concentrated about 10–40° E are the same stock as those found in African waters, especially as there has been no interchange between the two sides of the Indian Ocean or between the separate Antarctic groups. These connexions are of course noted by Rayner who says (p. 273): '...in comparison with Blue and Fin whales the Humpback shows less initiative and seems content to follow the same routes, returning to the same region season after season.'

In view of these recoveries of whale marks it can hardly be doubted that each of the Antarctic summer groups has its own migration route to the coastal waters of a continent lying approximately to the north of it. Thus the Humpbacks grouped in summer in 70–80° W are presumably those which move up the Chilean coast in winter. Of those grouped in 10–40° E some at least must migrate to East African waters. Others possibly reach the West African coasts, but no marks have been recovered there. Those in 80–100° E clearly migrate to the West Australia coast, and it may be inferred that the Ross Sea Humpbacks are identified with those found in New Zealand and East Australian waters. The winter destination of the depleted Scotia Sea group is not clear. They might belong to the east coast of South America, but if that were so one would have expected a more considerable Humpback fishery to have been established off the Brazilian coast. It may be that they migrate north-eastwards to the West African coast, and the fact that the decline in the Humpback fishery at South Georgia was closely followed by a decline in the catches at Angola (see Table 10, p. 234) favours this possibility.

These facts and inferences are summarized in Table 14 and Fig. 4, and for convenience most of the groups are provisionally named according to the continental region to which they are presumed to be related. Those numbered II–V in Table 14 correspond with Hjort, Lie and Ruud's areas II–V, but these authors' area I was only a small region around the South Shetland Islands (see p. 240). Fig. 4 may be compared with a map of the 'supposed migration routes of Humpbacks' drawn by Kellogg (1929, fig. 2, p. 473), and it will be seen that the two agree fairly well. There is no reason to suppose that any additional Pacific group of Humpbacks exists between the New Zealand and Bellingshausen Sea groups. There is no indication of any concentration of Humpbacks in this position in the observations of the 'Discovery II', and the coastal regions on both sides of the South Pacific sector have already been related to groups in the Antarctic.

Table 14. *Provisional classification of the southern stocks of Humpbacks*

Group	Approximate centre of summer concentration in the Antarctic	Coastal resort in winter
I. Chilean group	70–80° W (Bellingshausen Sea)	West coast of South America
II. Atlantic group (depleted)	10–35° W? (eastern Scotia Sea)	East coast of South America or more probably west coast of South Africa
III. African group	10–40° E (off Queen Maud Land)	Madagascar and East African waters and possibly west coast of South Africa
IV. West Australian group	80–100° E (off Queen Mary Land)	North-west coast of Australia (Shark's Bay, etc.)
V. New Zealand group	150–180° E? (Balleny Island and Ross Sea)	New Zealand and East Australian waters

It is to be inferred then that there are five more or less self-contained stocks of Humpbacks in the Southern Ocean. The existence of separate stocks was recognized in general terms by Rayner, and the analysis of catch statistics and marking positions has now enabled us to amplify his conclusions. The classification shown in Table 14 and Fig. 4 is of course liable to some modification. Perhaps a more exhaustive analysis of the positions of catches in the factories' log books would make it possible to define the limits of the Antarctic concentrations in a good deal more detail, and might suggest subdivisions of some of the main groups. It is possible that there is a slight infiltration from time to time from one group to another, and it might, for instance, be found that the West Australian group is less rigidly separated from the New Zealand group than from the African group. There might also be some exchange between the ill-defined South-West Atlantic group and the Chilean group.

The colour varieties of Humpbacks referred to on pp. 203–4 are of interest in connexion with this segregation of the stocks. Matthews (1937, p. 35) notes a difference in the proportions of the different colour groups in Humpbacks of South Georgia and South Africa on the one hand and those of New Zealand on the other, and infers 'the possibility of some degree of segregation between the South Atlantic, Indian Ocean, and New Zealand herds of Humpbacks'.

It is difficult to compare the magnitude of the different Antarctic groups, but there seems no doubt that larger numbers of Humpbacks resort in winter to the west sides of

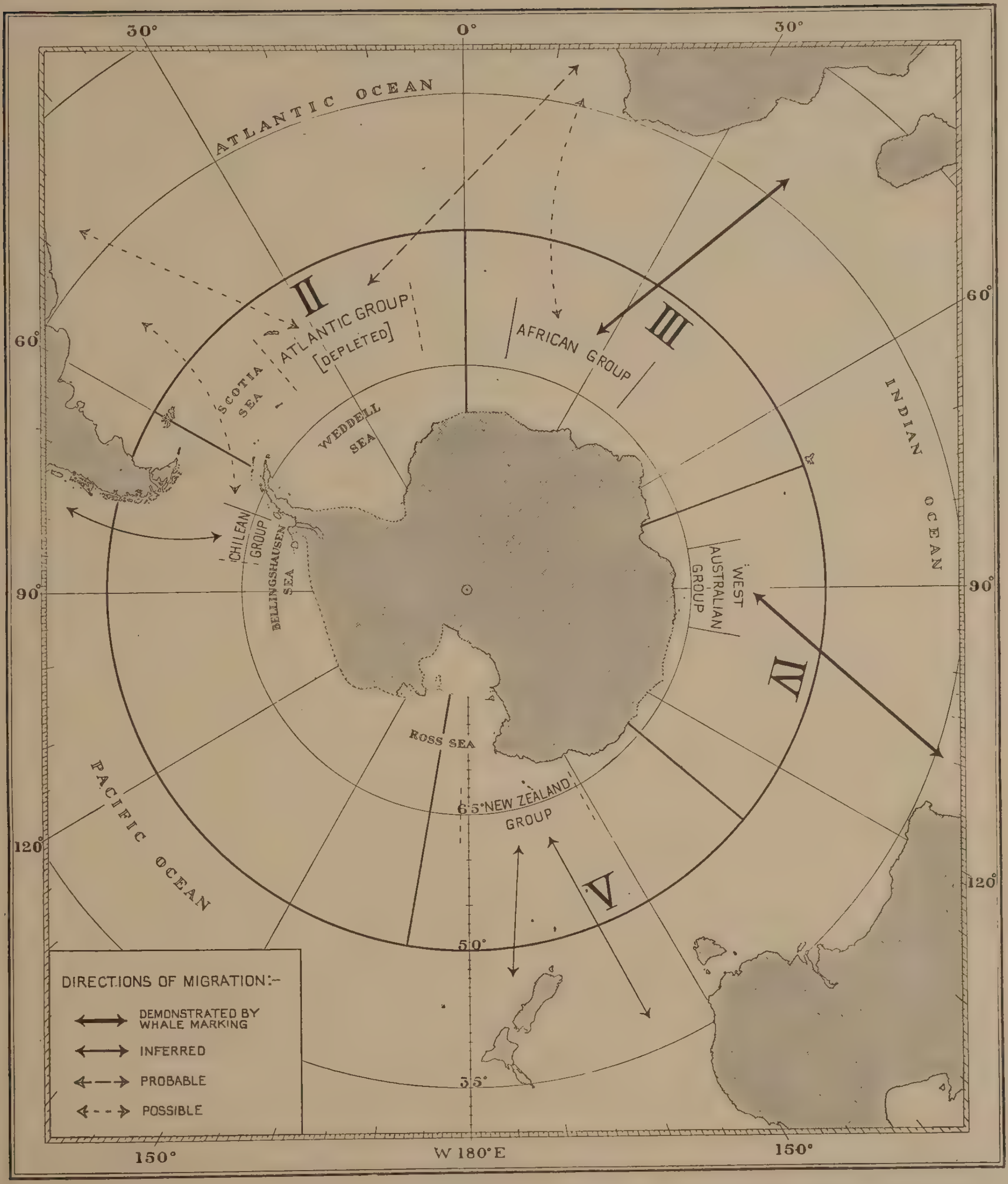

30°
0°
30°
ATLANTIC OCEAN
II
ATLANTIC GROUP
[DEPLETED]
SCOTIA SEA
WEDDELL SEA
AFRICAN GROUP
III
INDIAN OCEAN
60°
60°
90°
90°
CHILEAN GROUP
BELLINGSHAUSEN SEA
WEST AUSTRALIAN GROUP
IV
ROSS SEA
65°
NEW ZEALAND GROUP
V
PACIFIC OCEAN
120°
120°
50°
35°
150°
W 180° E
150°
DIRECTIONS OF MIGRATION:—
DEMONSTRATED BY WHALE MARKING
INFERRED
PROBABLE
POSSIBLE

Fig. 4. Segregation of the stocks of Humpbacks. Large roman numerals indicate Hjort, Lie and Ruud's areas II–V. Short meridional lines show the approximate limits of Humpback concentrations in the Antarctic (pecked when uncertain). Arrows indicate the directions of migration.

the southern continents than to the east. Larger numbers have certainly been caught on the west coasts, and the explanation is probably to be found in the hydrological conditions. Currents tend to flow southwards off the east coasts and northwards off the west coasts, so that in a given latitude the temperature is higher on the east than on the west side. Upwelling of cold water rich in nutrient salts gives rise to a more abundant fauna off the west coasts (especially that of South America), and it may be that whales thus have a better chance of finding some food than off the east coasts.

It is worth mentioning that the opinion has sometimes been expressed that the Humpbacks migrate northwards up the west coast of Australia, cross the Indian Ocean, and return through East African waters to the Antarctic. It is difficult to know on what grounds such a theory could be based. It receives no support from the evidence of whale marking, and on both sides of the Indian Ocean the whales have been described as moving northwards at first and returning southwards later. The suggestion is in any case refuted by the statistics of foetal length and yield of oil. If the Humpbacks took such a circular route the foetuses of those taken off Madagascar should have grown to a greater length than those of whales taken off Western Australia, but in the International Statistics (1938, no. XI, p. 35) the average length of the Australian foetuses is given as 13 ft. 11 in. and those of Madagascar as 13 ft. 3 in. Similarly, whales should become thinner through scarcity of food during their traverse of the Indian Ocean and those off Madagascar should yield less oil than those arriving off Western Australia from the feeding grounds of the Antarctic. But in the same issue of the Statistics (p. 32) the oil production per Blue whale equivalent is given as 101·5 barrels off Western Australia and 105·8 off Madagascar.

Matthews (1937) points out that there is a higher proportion of immature Humpbacks in catches off Natal and Saldanha Bay than at South Georgia. The International Statistics (1937, no. X, p. 21 and 1938, no. XI, pp. 24–31) give the following average lengths (in feet):

Winter whaling, 1937

	Males	Females	Total
Congo	37·44	40·32	38·73
Madagascar	39·27	39·06	39·19
West Australia	39·31	40·11	39·60
Cape Province and Natal	36·79	37·00	36·89

Summer whaling, 1936–7

	Males	Females	Total
Total Antarctic	39·78	41·38	40·59

This indicates that the average length of the whales found in summer in the Antarctic is slightly greater than that of those found in any of the winter coastal resorts, but it would seem that the highest proportion of immatures occurs in temperate waters (Cape Province and Natal) rather than in the tropics, if a lower average length may be taken as a criterion. Presumably there is a tendency among immature whales sometimes to stay in warmer waters rather than to migrate to the Antarctic.

BLUE AND FIN WHALES

The migrations of Blue and Fin whales are not so clearly defined as those of Humpbacks. They do not frequent coastal waters in the winter in the same way as Humpbacks, and direct observation is therefore more difficult. Furthermore, although whale marking has provided much valuable information on these two species, it has not yet demonstrated the range and direction of their annual migrations as it has for Humpbacks. All marking has been done in the Antarctic, for Blue and Fin whales cannot be found in sufficient concentrations in warmer waters in winter, and although many marks have been recovered in the Antarctic, only one from a Fin whale, and none from any Blue whale, has so far been recovered in warmer regions. This is not at all surprising, for the majority of Blue and Fin whales taken in warmer waters are small and immature, and cannot constitute a fair sample of those which have been marked in the Antarctic. Even if, in their northward migrations, the Blue and Fin whales cover distances comparable to the distances covered by Humpbacks, it is evident that the majority of at least the adult population do not resort to the coastal waters of the southern continents or come within range of the land stations and factory ships which operate in winter in temperate and tropical regions.

The single instance mentioned above of a marked Fin whale being taken in these waters is referred to by Rayner (1940, p. 268 and pl. lix). The mark was recovered at Saldanha Bay, Cape Province, from one of the comparatively few adult Fin whales which approach the South African coast. The whale was marked 2½ years earlier in the Antarctic almost directly south of the Cape of Good Hope. This appears to be the only item of direct evidence of a long-range northward migration of Fin whales. The indirect evidence for supposing that both Blue and Fin whales regularly undertake such migrations may be summarized as follows.

In the first place, Blue and Fin whales are closely related to Humpbacks, and since their habits, especially in relation to feeding and breeding, are very similar, one would expect them to undertake migrations of some similar nature. This expectation is supported by the statistics of catches in different localities, by changes in the composition of the catches during the Antarctic whaling season, by variations in the fatness of the whales, and by the incidence of parasites and scars.

Perhaps the best evidence for a migration to the Antarctic in summer and to temperate regions in winter is the fact that the whalers have seldom found it worth while to operate in the Antarctic in winter or in the warmer waters in summer. Various authors have commented on this (e.g. Harmer, 1931, p. 108, etc.). At South Georgia the whaling season has usually lasted from September or October to April or May, and in the Antarctic pelagic whaling, before a restricted season was imposed by international agreement, the season covered much the same period, the largest catches being in December, January and February. On the other hand, at such centres as Saldanha Bay and Durban, the two principal stations at which Blue and Fin whales are taken in warmer waters, the season lasts from April or May to October or November. This is most readily explained on the ground that the majority of Blue and Fin whales which inhabit the Antarctic in summer move northwards in winter to warmer waters in temperate regions. The fact that the catching of Blue and Fin whales was at one time continued on a small scale through the winter at South Georgia shows that the northward migration does not involve the withdrawal of the whole population of these species from the higher latitudes.

Variation in the fatness of whales is well known as evidence of their migrations. The changes in thickness of the blubber were described by Mackintosh and Wheeler (1929, pp. 363–72), and it was shown that at South Georgia Blue and Fin whales became fatter towards the end of the summer, while at South Africa they become thinner as the winter goes on. The increasing production of oil per Blue whale unit during the Antarctic pelagic whaling season is shown graphically by Bergersen, Lie and Ruud (1939, p. 12), and although this increase might be partly due to the increasing proportion of Fin whales in the catches (see p. 208) it is no doubt largely caused by a real increase in fatness. The argument is, of course, that since whales caught in the Antarctic increase in fatness during the summer season there must be a period in which a corresponding decrease occurs. Whales taken in temperate waters in winter show such a decrease, and since there is abundant food in the Antarctic and little food in the warmer regions it is to be supposed that the fat, well-fed whales at the end of the Antarctic summer migrate to the warmer regions where, with little to eat, they lose their fatness and return as thin whales to the Antarctic in early summer.

For reasons already given (see p. 214) the occurrence of the parasites *Pennella* and *Coronula*, and of the pits and scars on the skin, is evidence, though not conclusive proof, of seasonal migrations.

Most of this evidence has been described by previous authors, but it is assembled here for completeness, and it can leave no doubt that there is a general tendency for Blue and Fin whales to undertake long annual migrations between the Antarctic and temperate or tropical waters, though this is not to say that the Antarctic is completely deserted in winter or the warmer waters in summer.

Although much is known of the distribution of Blue and Fin whales in the Antarctic in summer, hardly anything is known of their destination when they migrate to the north in winter. They evidently do not concentrate in coastal regions as does the Humpback, and it does not appear that they are ever seen in large numbers in warmer waters in winter as they are seen in cold waters in summer. It can only be supposed, as Harmer suggests (1931, p. 135), that they become very much dispersed over an immense area in winter, some perhaps penetrating into tropical waters, many being scattered in the open ocean in subtropical and sub-Antarctic waters, and some staying in the Antarctic without any major journey to the north. If there were any localities, even in the open ocean, to which these species resorted in any large concentrations in winter it is difficult to believe that they would not have been observed from time to time.

In the Antarctic Blue and Fin whales are more evenly distributed than Humpbacks and do not concentrate in such definite groups. Their distribution, being less clearly defined, is more difficult to elucidate, and the effect of whaling, in so far as it alters the relative abundance of whales in different regions, has added a new complication. However, Rayner (1940) has shown that like Humpbacks they tend as a general rule to return to the same Antarctic locality after their winter migration to warmer waters, and that their movements from one Antarctic locality to another are to some extent restricted. This is perhaps the most important fact which has emerged from whale marking, for it is the key to the whole problem of whale distribution. It implies, among other things, that although Blue and Fin whales are distributed more or less continuously around the Antarctic continent there is no indiscriminate shuffling of the stocks, either in the Antarctic or in warmer waters; and a reduction of the stock, for instance as a result of whaling, is to be regarded, at least temporarily, as a local reduction rather than a subtraction from the general pool of whales in the Southern Ocean.

Although Blue and Fin whales in the Antarctic are not separated into clearly isolated communities, the movements of factory ships suggest a grouping which is not unlike the grouping of Humpbacks. These movements of the whaling fleet, and the positions and numbers in which whales of each species are caught, naturally constitute one of the most fruitful sources of evidence on the actual distribution of whales. Reference has already been made to the four major whaling grounds distinguished by Hjort, Lie and Ruud, and it has been shown above that in each of these areas there is a distinct community of Humpback whales, each of which is related to a corresponding coastal region in lower latitudes. The areas II–V (see Fig. 2) were not, however, defined on the basis of Humpback catches, but on the grouping of the whaling fleet as a whole which must be influenced primarily by the distribution of Blue and Fin whales, especially the former.

Hjort, Lie and Ruud have shown that there is a remarkable similarity in each successive season in the distribution of the factory ships which applies not only to their concentration in separate groups in each of the areas, but also to movements during the season. In the third of their series of articles (1933, p. 11) they point out that these things are not a matter of chance, but are due to a regularity in the migrations of whales which is connected with the hydrological conditions, and they postulate more or less self-contained current systems, at least in areas II, III and IV. In the same article (p. 12) they say: '...the remarkable agreement we have found in the November charts for the last two seasons suggests that there is a regularity in the distribution of the grounds which extends even to details.' Some variation of course arises from season to season as a result for instance of exceptional ice conditions, and the relative intensity of whaling in the different areas is affected perhaps by the decline in the stock of Blue whales. This, however, does not affect the general conclusion that since the factory ships become more or less segregated on four distinct whaling grounds (in areas II–V) it is to be supposed that there is a tendency for stocks of Blue and Fin whales to become segregated into corresponding groups.

For a better assessment of this tendency to segregation the statistics of catches and the data from the 'William Scoresby' have been treated in the same way as for Humpbacks. The total catches of Blue and Fin whales, and the 'whales per day', are given in Table 11 for two seasons, but for these two species more than two seasons' data are available, and Table 15 and Fig. 5 are therefore drawn up for the four seasons, 1934–8. 'Factories' days' are not given in the statistics for seasons prior to 1934–5, so the earlier seasons, when some ships worked in area V, are not included. During the period 1934–8, however, it is clear that Blue whales, though scarce in area II, were taken in large numbers between 20 and 40° E in area III, and again between 80 and 100° E in area IV. This suggests a grouping very similar to that of Humpbacks. Fin whales dominate the catches in area II between 20 and 50° W; in area III there is a maximum in about the same position as the Blue whale maximum, but in area IV the maximum for Fin whales is some distance to the east of that for Blue whales. The well-known scarcity of whales about 60 and 70° E is clearly seen. The graph of 'whales per day' gives

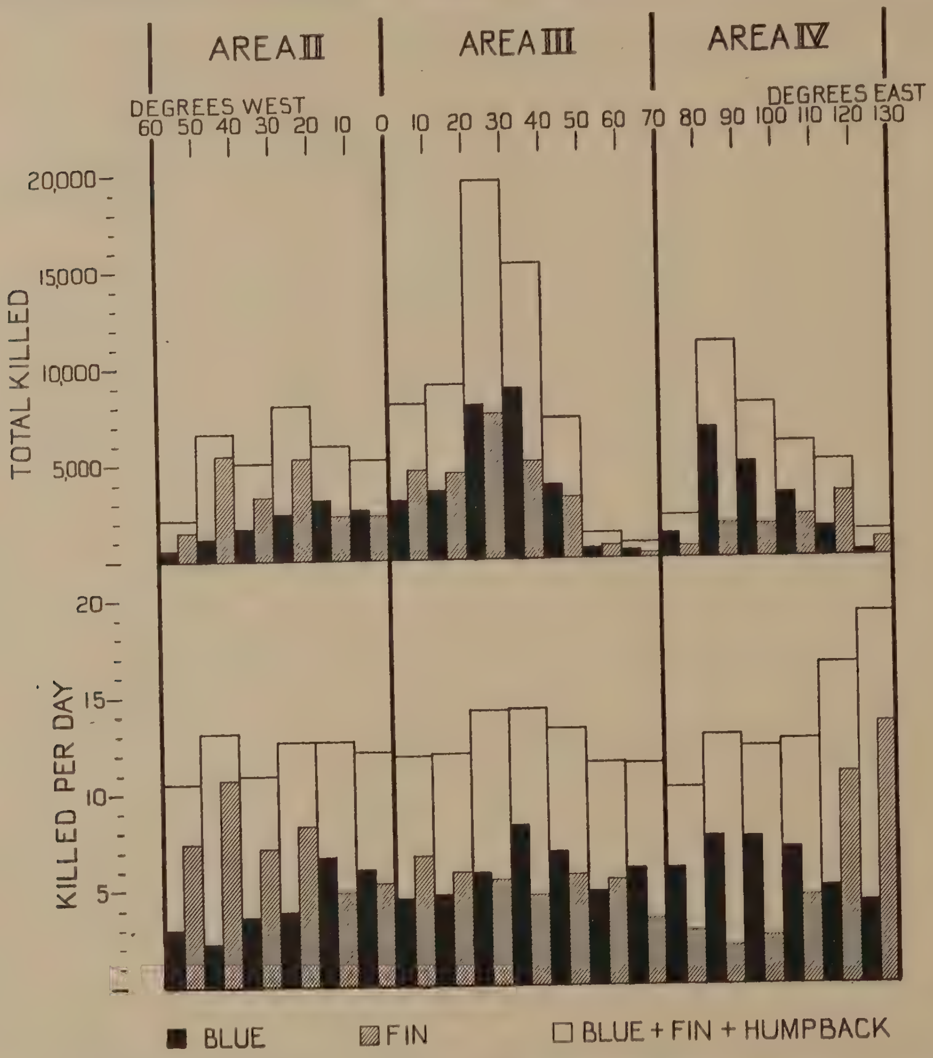


Fig. 5. Total Blue and Fin whales killed, and Blue and Fin whales killed per day, in every 10° of longitude in 1934–8. From Table 15.

less definite results. Without intimate knowledge and experience of whaling methods it is difficult to say how far this is a valid indication of the real distribution of Blue and Fin whales. For instance, the very high rate of Fin whales per day in 120–130° E is derived from a small catch in the 1937–8 season only, which, however, was taken in a relatively very small number of days, and its significance is rather doubtful. However, the 'Blue whales per day' show the same maxima, though less pronounced, as in the total catches. The 'Fin whales per day' are more difficult to interpret. There is clearly a concentration in area II, but in areas III and IV the catch per day does not fluctuate in the same way as the total catches. It must be remembered that the Blue whale is the more valuable species, and it is difficult to say how far the Fin whale catches are affected by the abundance or scarcity of Blue whales. This factor does not apply to the 'William Scoresby' data. Fig. 6 confirms the inference that Blue whales, though scarce in area II, tend to segregate in area III between 20 and 40° E, and in area IV between 80 and 100° E. The Fin-whale curve is in some ways similar to that of Fin whales caught per day in Fig. 5, especially in the peak at 40–50° W and the scarcity in 80–90° E, but there is evidently no great scarcity of Fin whales anywhere between 80° W and 60° E. A significant feature of Fig. 6 is that in 70–80° W (in the Bellingshausen Sea) there is not only

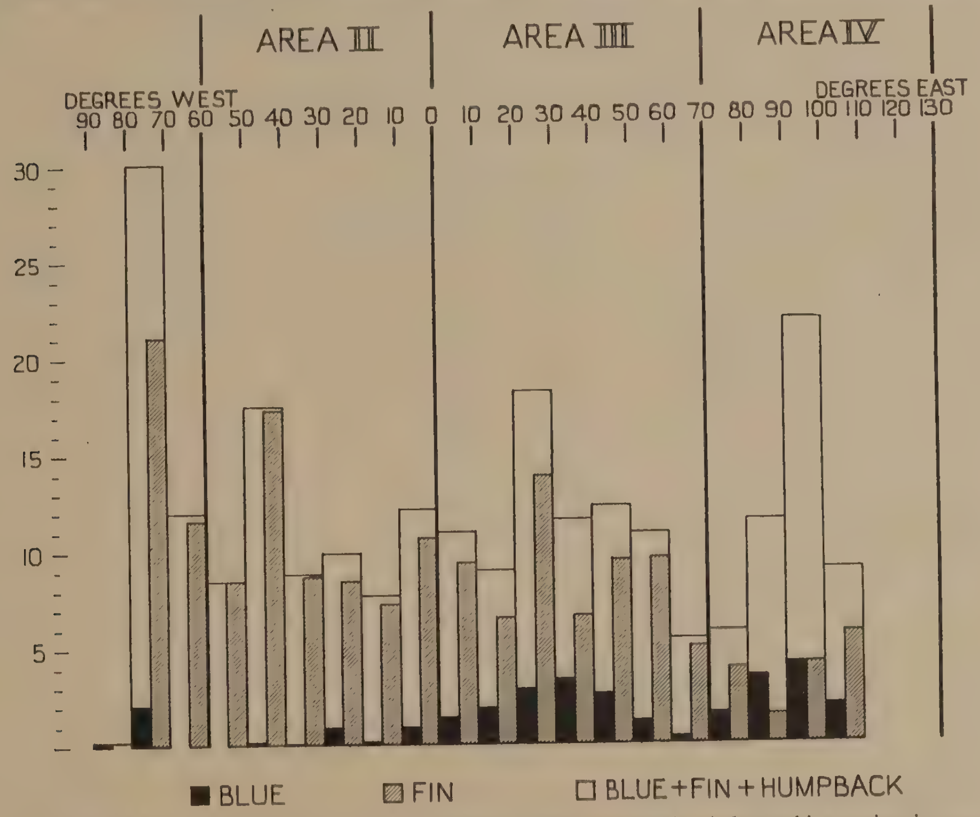
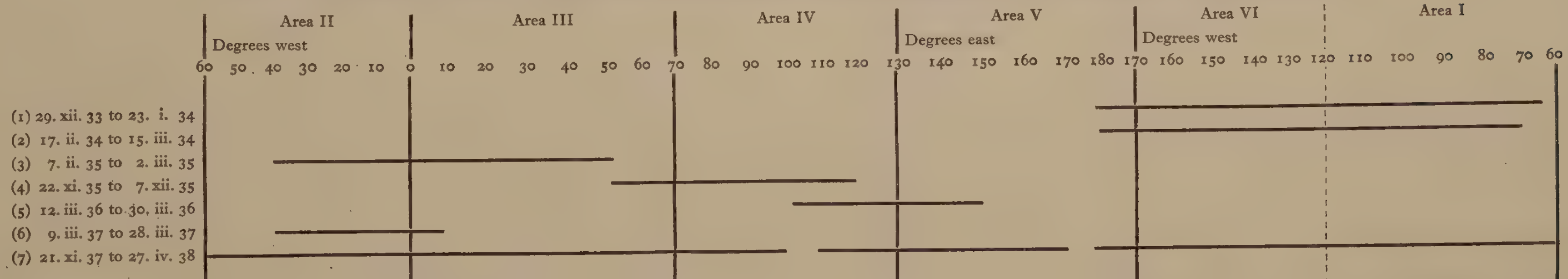


Fig. 6. Blue and Fin whales shot at per day during the William Scoresby's whale-marking cruises in 1934–8. From Table 12.

Table 15. *Whales caught south of 50° S in four seasons, 1934–8*

	Area II						Area III							Area IV					
	Degrees west																		Degrees east
	60–50	50–40	40–30	30–20	20–10	10–0	0–10	10–20	20–30	30–40	40–50	50–60	60–70	70–80	80–90	90–100	100–110	110–120	120–130
Factories' days	206	507	463	633	471	431	683	758	1375	1070	552	114	69	214	867	646	468	301	69
Blue																			
Whales caught	622	1172	1687	2458	3158	2617	3127	3576	8002	8862	3850	556	419	1299	6687	4938	3325	1538	299
Whales per day	3·02	2·31	3·64	3·88	6·70	6·07	4·58	4·72	5·82	8·28	6·97	4·88	6·07	6·07	7·71	7·64	7·10	5·11	4·33
Fin																			
Whales caught	1531	5423	3322	5281	2310	2316	4610	4466	7549	5036	3177	624	238	599	1731	1663	2153	3290	930
Whales per day	7·43	10·70	7·17	8·34	4·90	5·37	6·75	5·89	5·49	4·71	5·75	5·47	3·45	2·80	2·00	2·57	4·60	10·93	13·48
All species																			
Total caught	2170	6630	5075	8015	5962	5233	8124	9072	19569	15261	7298	1315	792	2190	11184	7970	5917	4978	1321
Total per day	10·53	13·08	10·96	12·66	12·66	12·14	11·89	11·97	14·23	14·26	13·22	11·54	11·48	10·23	12·90	12·34	12·64	16·54	19·14

Table 16. *Estimated numbers of whales observed during selected passages of the 'Discovery II' south of 50° S*



	Area II						Area III							Area IV						Area V					Area VI					Area I					
Total whales	3	16	15	43	23	40	119	117	95	181	29	11	43	31	108	36	34	36	158*	82	95	116	117	1	78	96	77	27	8	—	82*	196*	96*	17	9
Total days	1½	3	8	9	8½	6	17	7½	7	7½	5½	5½	4½	4	4½	6½	8½	9	5	4½	7	2	7	10½	12	5½	5	5½	6	6½	7	4½	5	9	6
Whales per day	2·0	5·3	1·9	4·8	2·7	6·7	7·0	15·6	13·6	24·1	5·3	2·0	9·6	7·7	24·0	5·5	4·0	4·0	31·6	18·2	13·6	58·0	16·7	0·1	6·5	17·5	15·4	4·9	1·3	0·0	11·7	43·6	19·2	1·9	1·5

* Includes some very rough estimates.

a peak for Humpbacks but also a marked maximum of Fin whales and a smaller but still distinct concentration of Blue whales. The significance of the high proportion of Fin whales shot at compared with Blue and Humpback whales is discussed below (p. 263, etc.).

A preliminary analysis of some of the records of whales observed during the voyages of the 'Discovery II' is of some assistance here. These observations, however, are limited and in certain respects unsatisfactory, and a little explanation is necessary. During the voyages of the 'Discovery', 'Discovery II' and 'William Scoresby' it has been the practice to record all whales seen, and, as far as possible, the date, time, position, species, numbers in schools, direction of movement, etc., would be logged, together with the name of the observer. The principal object of course was to gain information on general distribution, abundance and movements, and to compare distribution with local oceanographical conditions. It was evident from the beginning, however, that such records were quantitatively unreliable. The vast majority of whales noted are seen as distant spouts, and the number of such spouts which can be seen must depend in a major degree on the ever-changing conditions of visibility. Estimation of the number of whales in a school is also difficult, even at short range, and it is often uncertain whether spouts seen at intervals are from the same whale or from several whales. This risk of counting the same whale more than once is not of much importance when the ship is steaming at normal speed on a straight passage, but causes much uncertainty when she is doing intensive work in a limited area. Reliable identifications of species are especially difficult (see p. 261) and have been far too few to give any idea of the distribution of the species separately within the different areas. Unidentified whales, however, can almost always be distinguished on the one hand as either Blue, Fin or Humpback, or on the other hand as some smaller species such as a Minke.

During the commissions of the 'Discovery' (1925–7) and the earlier work of the 'Discovery II' and 'William Scoresby', investigations were largely concentrated in the limited whaling grounds of the Falkland Islands Dependencies, and in view of the uncertainties involved, less importance was attached to direct observations on whales than to the routine oceanographical research. Later investigations were spread over the whole Southern Ocean, and in the third, fourth and fifth commissions of the 'Discovery II', when long voyages were arranged through the belt of ocean mainly inhabited by whales, a special look-out, in addition to the officer of the watch, was continuously on duty during passages suitable for such observations. For this reason the best comparable data are forthcoming from the ship's last three commissions (1933–9). Table 16 and Fig. 7 show the numbers of whales presumed to be Blue, Fin or Humpback, estimated to have been seen south of 50° S between each 10° of longitude during such passages in the summer months. Many series of observations are omitted which for one reason or another were not fairly comparable. Fig. 8 shows the route taken by the ship on each occasion. Table 16 also gives the approximate time (to the nearest half-day) spent by the ship in each 10°, and finally the average number of whales estimated to have been seen per day. Sometimes where large numbers of distant spouts were seen the estimated numbers are little more than guesswork, and no allowance is made here for varying weather conditions and visibility. Furthermore, the whaling grounds are not very evenly sampled in the different areas, and the observations of a single ship in such a vast expanse of ocean must in any case be of doubtful value, for even in the major areas of concentration whales are distributed in a patchy manner in what may be loosely described as herds, and such herds may easily be missed. The observations can therefore give only a very rough indication of distribution. They are, however, distributed all round the Southern Ocean, and the 'whales per day' are plotted for what they are worth in Fig. 7.

Comparatively few whales have been seen in area II, but it may well be that the observations have not fairly covered the modern whaling grounds here which are mainly off the pack-ice of the Weddell Sea. In area III, according to expectation, plenty of whales are seen between 10 and 40° E, and in area IV the peak in 80–90° E corresponds with peaks at about the same position in Figs. 5 and 6. The considerable numbers seen about 130° E suggests that the division between areas IV and V is not necessarily marked by any great scarcity of whales. It is perhaps significant that this peak of observed whales corresponds with the large number of 'Fin whales killed per day' shown in the lower right-hand corner of Fig. 5, and it may well be that the division between areas IV and V holds good for Blue whales but not for Fin whales. The high peak in the middle of area V is dependent on a single set of observations. Perhaps the most instructive part of Fig. 7 is that which represents the whales seen in the Pacific sector between 170 and 60° W. Three cruises were made in this sector (see Fig. 8), each on a zigzag course covering a belt of ocean off the pack-ice which corresponds in position and extent with the pelagic whaling grounds in other parts of the Antarctic. Some con-

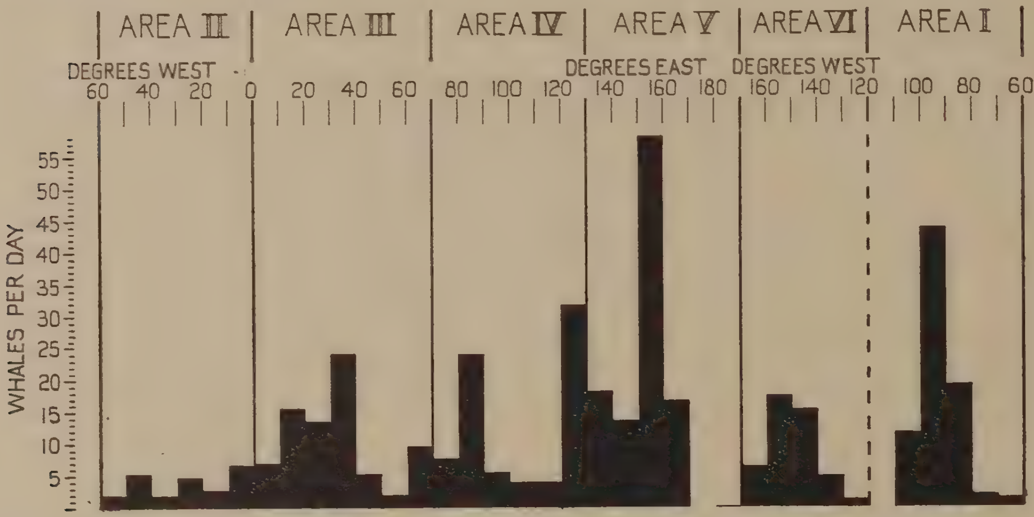


Fig. 7. Estimated numbers of whales, presumed to be Blue, Fin or Humpback, seen per day south of 50° S during selected passages of the 'Discovery II', 1933–9. From Table 16.

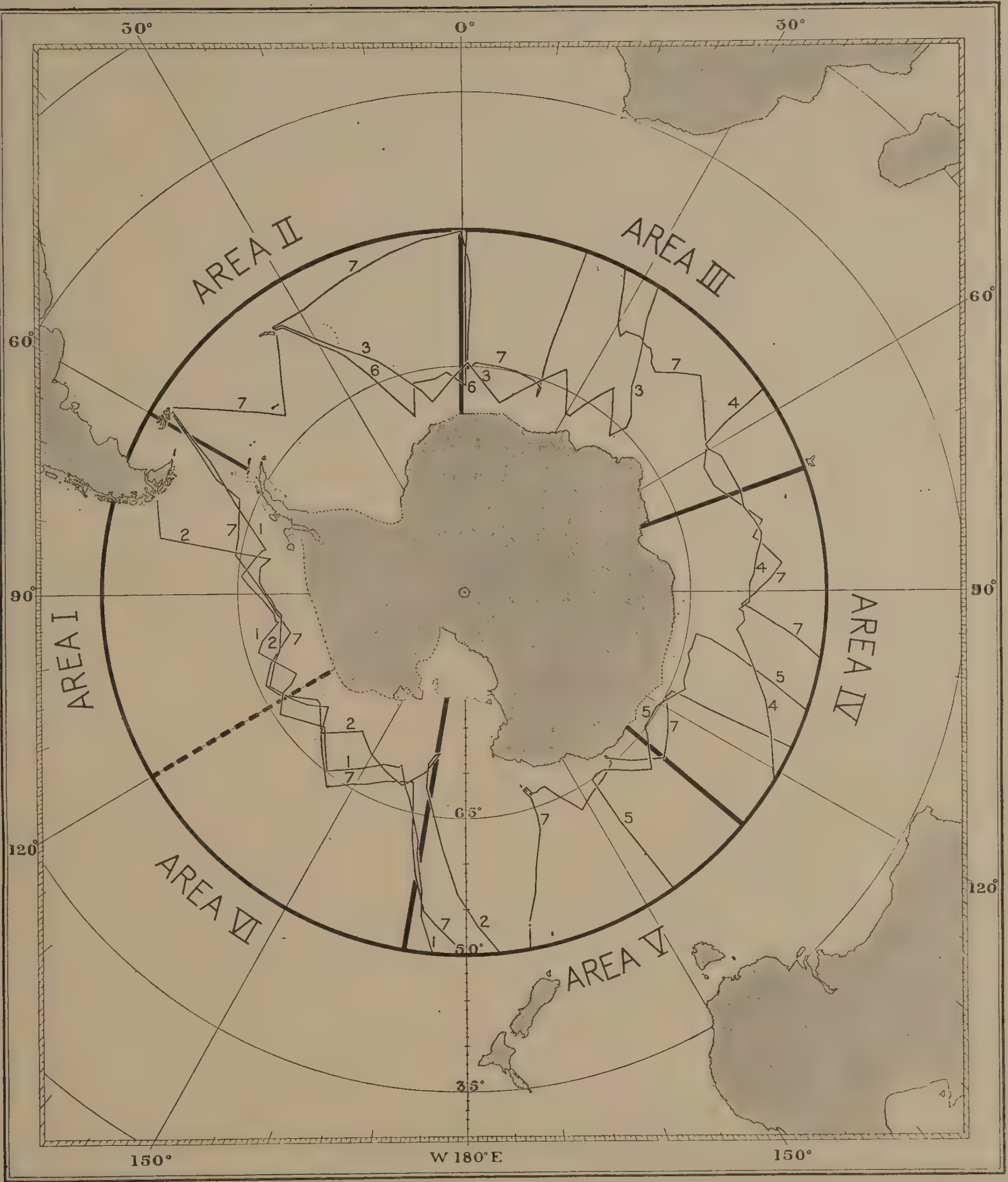

30°
0°
30°
60°
60°
90°
90°
120°
120°
150°
W 180° E
150°
AREA I
AREA II
AREA III
AREA IV
AREA V
AREA VI
65°
50°
35°
1
2
3
4
5
6
7

Fig. 8. Tracks of the 'Discovery II' from which the data in Table 16 and Fig. 7 are derived. Showing the suggested new areas I and VI. The numbering of the tracks corresponds to the numbers of the periods on the left side of Table 16.

siderable numbers of whales were seen from time to time, but on each occasion whales were scarce between 110 and 130° W. No whaling has been done in this part of the Antarctic, and it is not covered by Hjort, Lie and Ruud's areas I–V. Their area I was a small area arbitrarily arranged for the now obsolete whaling around the South Shetland Islands. It would seem reasonable now to call the south-eastern part of the Pacific sector area I, and this would accommodate the 'Chilean' group of Humpbacks (see Table 14, p. 246) and the peak of 'observed' whales seen in Fig. 7 between 90 and 100° W. The western boundary of area I can be provisionally fixed at 120° W, and since Hjort, Lie and Ruud fixed 170° W as the eastern limit of area V, the sector between 120 and 170° W can be called area VI pending fuller information on the distribution of whales on this side of the Antarctic. These areas I–VI are shown in Fig. 8. We should not expect to find Humpbacks in area VI for, as mentioned on p. 246, the coastal regions on the east and west sides of the Pacific have been connected with the Humpback groups in areas I and V. It may be, of course, that there is no real boundary between areas V and VI, for although Fig. 7 shows a gap at this point it is clear from Fig. 8 that the observations of the 'Discovery II' did not fairly sample the region around the 180th meridian.

It seems that we are at least justified in concluding that Blue whales, and possibly also Fin whales, in the Antarctic summer tend to segregate in the same five regions as the Humpbacks, but that, while in Humpbacks the segregation is almost complete, in Blue whales the tendency is apparent only in the fact that rather larger numbers are to be found in the areas of concentration than elsewhere. The numbers of 'Fin whales per day' in Figs. 5 and 6 do not show any clear segregation of this species in areas II–IV, but it is believed that the 'observed' whales in Fig. 7 include far more Fin whales than other species, and here there are distinct signs of segregation. Whale marking also (see below) suggests that Fin whales in the different areas may belong to distinct communities. The evidence for the segregation at least of Blue whales is based (*a*) on the division of the whaling fleet into separate groups which presumably represent the opinion of experienced whalers as to the localities in which whaling is most successful, (*b*) on comparisons of the catches in different longitudes which are treated as samples of the density of the whale population, and (*c*) on the whales marked or shot at by the 'William Scoresby' which are treated in the same way. Figs. 3, 5 and 6 are perhaps liable to misinterpretation in their details, for the statistics are to some extent influenced by extraneous factors, but this hardly affects the general conclusion. Some support is to be found in the observations of the 'Discovery II', and these observations suggest provisional boundaries to the new areas I and VI in the Pacific sector.

The recoveries of whale marks described by Rayner (1940) are of special importance when considered in relation to the grouping of Blue and Fin whales. His charts showing the positions of marking and capture of Blue and Fin whales killed in the same season as they were marked (pl. xlvii and liv) clearly show separate groups of whales in areas II–IV, none of which has moved from one area to another. As he points out, however, there is some lateral dispersal after an interval of a year or more. Thus after one or two years some Blue and Fin whales had crossed from area III to area IV, and two Fin whales had crossed from the Bellingshausen Sea (area I) into area II. Although the scarcity of whales at the boundary between areas III and IV would suggest a sharper distinction between these two areas than between areas II and III, the recoveries of marks, so far as they go, suggest a more distinct separation of areas II and III, for very few marked whales crossed the Greenwich meridian. One Fin whale marked in area III was captured three years later in area II, and a Blue and a Fin made the same crossing after four years.

It may be concluded that, just as Blue and Fin whales are less definitely segregated in the different areas than Humpbacks, so they cross more readily from one area to another. Rayner, however, shows that the majority return to the same area after their northward migration. Since out of a considerable number of marks recovered there were no instances of a whale crossing from one area to another during the same season it seems likely that the cross over takes place either in temperate regions or in the course of the migration; but the two Fin whales which moved from the Bellingshausen Sea through the Drake Strait into area II may have done so in a high latitude in summer.

This segregation of the stocks of whales in the Antarctic has been considered here at some length because it is a matter of primary importance in the problem of the distribution of whales and the effect of whaling on the stock, and it is evident that such subjects as the relative numbers of each species, the age composition of the stock, the effect of whaling, etc., can with advantage be investigated separately for the separate areas, provided that sufficient data are available. There is no doubt that the major communities of whales can be subdivided into smaller groups some of which have been recognized by Hjort, Bergersen, Lie and Ruud, and by Rayner, as certain minor concentrations or streams of movement in particular localities at certain times of year. This, however, opens up a more complex field of inquiry which would be rather beyond the scope of the present general discussion.

As a probable explanation of the grouping of whales in the separate areas Hjort, Lie and Ruud postulated separate cyclonic systems in the hydrological conditions. Deacon's account, however, of the principal hydrological features of the Southern Ocean does not point to any obvious connexion between the current systems and the separate whaling grounds. The distribution of Humpbacks, indeed, strongly suggests that the Antarctic groups, which correspond to the distinct whaling grounds, are dependent rather on the positions of the southern continents than upon hydrological conditions; and it may be that since Blue and Fin whales tend to concentrate in much the same regions in the Antarctic, they too, although they do not crowd into temperate coastal waters, are still loosely influenced by the southern land-masses, and that it is the subsidiary features of their distribution that are controlled by their immediate environment.

So far we have considered only the longitudinal distribution of whales in the Southern Ocean, that is to say their distribution and varying abundance in different sectors and between different longitudes. The latitudinal or north-south distribution is closely concerned with the hydrological conditions and distribution of pack-ice, and can perhaps be more properly investigated in detail when the long-range oceanographical data accumulated by the 'Discovery II' have been more fully worked out (see p. 199). In the meantime it is appropriate to draw attention here to certain broad features, and to indicate in general terms the connexion between the distribution of whales and their physical environment.

Most, if not all, truly oceanic organisms in the Southern Ocean have a circumpolar distribution and tend to occupy a more or less well-defined zone, the boundaries of which are liable to shift with seasonal changes in the environment. Since whales are migratory animals this zonal distribution applies only to their summer habitat in the Antarctic. Here the greater part of the stocks of Blue, Fin and Humpback whales occupy a circumpolar belt varying from about 200 to 600 miles wide, and bounded to the south by the pack-ice edge. Hansen's *Atlas over Antarktis og Sydishavet* (1936), gives an instructive picture of the extent of the zone within which whales are taken by the factory ships. It probably gives a better impression of the distribution of Blue whales than of Fin and Humpback whales, for at that time far more Blue were taken than other species.

The Antarctic convergence, the point at which the cold Antarctic surface water sinks abruptly below the warmer sub-Antarctic water (see Deacon, 1937, p. 22), is a line running roughly round the middle of the Southern Ocean (see Fig. 2). Although it lies far to the north of the Antarctic circle it is, from the hydrological point of view, the northern boundary of the Antarctic waters. Immediately to the south of the convergence in a zone which is completely, or almost completely, devoid of the krill on which the whales feed. It appears to be identifiable by its plankton population (see Mackintosh, 1934, p. 150, and Hart, 1942), and it is not normally occupied by whales except when they cross it in the course of their migrations. Beyond this is the zone occupied by the krill and mostly covered by pack-ice in winter (see Mackintosh and Herdman, 1940). With the retreat of the ice during the summer the great feeding grounds of the Antarctic are opened up and the whales penetrate into higher latitudes. The majority are then found between the 2° C. isotherm and the edge of the pack-ice. Although Blue, Fin and Humpback whales may anywhere be found together it is well known that Blue whales have a tendency to reach higher latitudes and colder water than Fin whales. Some important changes take place during the summer in the composition of the Antarctic whale population, the main herds of Fin whales for example arriving in high latitudes rather later than the Blue whales, but these are dealt with below (pp. 269–78).

RELATIVE ABUNDANCE OF THE DIFFERENT SPECIES

Although it is at present difficult to calculate even the order of magnitude of the actual numbers of the species of whales in the Southern Ocean, it is possible to gain some idea of their relative numbers. For this purpose the Discovery Committee's data, though limited, are more instructive than the statistics of catches, for the proportions of species in the catches are strongly influenced by selection. Thus one species may be caught in larger numbers than another either because it is more valuable, because the other receives partial protection, and so on. The statistics of catches, however, are helpful in showing variations of the species ratio in different Antarctic areas.

The catches listed in Table 10, p. 234, cover a long series of years during which changes have occurred in the stocks and in the selection of species by the whalers, and since we are more concerned here with the present or recent condition of the stock it will be convenient for the moment to take the five years preceding the 1938–9 season, for from 1938 partial protection of Humpbacks was imposed by international agreement. This period will also correspond with the greater part of the Discovery Committee's relevant data. Right whales may be disregarded since they receive total protection. Sperm whales also may be omitted, since their occurrence in the Antarctic is not representative of the whole stock of that species. Taking from Table 10 the total catches in summer whaling from 1933–4 to 1937–8 and in winter whaling from 1934 to 1938, we get the following figures:

	Blue	Fin	Sei	Humpback
Total caught	81,598	76,198	1,753	27,638
Percentage	44	41	1	14

Perhaps the only inferences which can be drawn from these figures are as follows. Since Blue and Fin whales were caught in roughly equal numbers, and since Blue whales are more valuable than Fin whales, there must have been a larger number of Fin than Blue whales available during the period in question. Since Sei whales are of little value, and since on account of their more northerly distribution they are not likely to be fairly represented in the Antarctic catches, their existing numbers must be more, and probably considerably more, than 1 % of the total of the four species. Of Humpbacks it can only be said that on the one hand they are less valuable than Blue and Fin whales but on the other hand they are easily caught, and it may be that 14 % is not far from the true proportion in which they exist.

The direct observations from the Committee's ships, and the limitations of the data so obtained, are described above on p. 255. In comparison with the total number of whales seen, the number actually identified as Blue, Fin, Humpback, etc., is quite small. Species can be identified with certainty only at short range and by observers who are thoroughly familiar with their appearance. Even at short ranges there is little to distinguish, say, a Blue whale from a Fin whale except the slight difference in the shape of the dorsal fin. The great majority of whales logged are too far off for this feature to be clearly seen, and it has not generally been the practice for the ship to alter course to get a nearer view of whales seen at a distance, for the numbers noted would hardly then be a random sample of the population. The shape of the spout differs a little in the different species, but this is a very uncertain criterion. It must be affected by the wind, and perhaps also by atmospheric temperature and humidity, and it is doubtful whether even experienced whalers would not be liable to error. Finally, the personal error must be considered, for a constant look-out for whales involves spells of watching by different observers with different degrees of experience.

The best data again are forthcoming from the third, fourth, and fifth commissions of the 'Discovery II'. On the fifth commission especially specific identifications were much surer, for by then there were more persons on board who had had experience of whale marking and of work at whaling stations. Mistakes are so easily made that many doubtful identifications must be eliminated as too uncertain to be of any value. The distinction in Table 17 between 'certain' and 'probable' identifications is inevitably to some extent a matter of opinion, but in drawing up the table I have put in the first category only those records which were noted as certainties by observers who had had experience of whale marking or work at whaling stations and had thus seen large numbers of whales at close quarters. In the second category are included records noted by the same observers as 'probable' and some observations by other persons either at very close range or confirmed by more than one observer. Identifications by less practised observers are disregarded. The figures are thus curtailed but should be reliable, and I believe that Table 17 is a fair statement of the proportions in which the species were actually seen, except that the ratio of Humpbacks might be a little too low, for it is sometimes difficult to be certain of a Humpback at ranges at which the dorsal fin of a Blue or Fin whale can be distinguished.

Table 17. *Species ratio by observations at sea*

	Numbers				Per cent		
	Blue	Fin	Humpback	Total	Blue	Fin	Humpback
Certain or almost certain	103	587	49	739	13·9	79·5	6·6
Probable	70	223	18	311	22·5	71·7	5·8
Total	173	810	67	1050	16·5	77·1	6·4

The most important figures shown in this table are the percentages of the certain or almost certain identifications, and it will be seen that 13·9 % were Blue, 79·5 % Fin and 6·6 % Humpback. The 'probable' identifications give a higher percentage of Blue whales, and it is a curious fact that the more doubtful identifications are admitted the higher becomes the proportion of Blue whales.

These observations have been distributed very widely in the Southern Ocean, but the quantity of data is admittedly small and is not very evenly distributed in the different areas, so that the ratio needs checking from other sources of information. For this purpose we have an instructive body of data in the records of whales which have been marked or shot at.

Taking first the whales actually marked, Rayner (1940, p. 252) gives a table showing the numbers of whales marked by the 'William Scoresby' operating on the oceanic whaling grounds of the Antarctic, by hired whale catchers around South Georgia, and by the 'Discovery II'. The proportions are shown in Table 18.

There is here a very striking similarity between the species ratio by observation and by whales marked, especially in the Blue/Fin ratio which works out at 1 to 5·7 by observation and 1 to 5·9 by marking. It should be noted, however, that a larger number of observed whales have been identified in the Falkland Islands sector (i.e. in area II, see Table 20, p. 264) than in other parts of the Antarctic, and although most of the 'William Scoresby's' marking has been on the eastern grounds, the South Georgia figures give a similar bias to the total marking ratio. The differences between the marking ratios for the 'William Scoresby' and for South Georgia are clearly due to the fact that South Georgia is in area II while the 'William Scoresby' worked for three seasons in areas III and IV and only one in area II. This, of course, explains the big discrepancy in the Humpback ratio, since this species is so scarce in area II.

Table 18. *Species ratio by numbers marked*

	No. marked				Per cent		
	Blue	Fin	Hump-back	Total	Blue	Fin	Hump-back
'William Scoresby', 1934–8	394	2101	540	3035	13·0	69·2	17·8
South Georgia, 1932–7	274	1804	7	2085	13·2	86·5	0·3
'Discovery II', 1933–9	—	10	1	11	0·0	90·9	9·1
Total	668	3915	548	5131	13·0	76·3	10·7

The Blue/Fin ratio, which indicates such a heavy preponderance of Fin whales, is of much importance, but consideration must be given to a possible source of error in so far as the ratio is calculated from observations at sea. As mentioned above, it has not been the practice for the 'Discovery II' to alter course to get a nearer view of the whales seen at a distance. If, then, it were found that Fin whales exhibited more curiosity than Blue whales, and had a habit (in the manner of dolphins) of deliberately approaching a ship, the number of Fin whales identified would be unduly high in comparison with Blue whales. But, on the other hand, if this were so we should expect a lower proportion of Fin whales in the 'William Scoresby's' data, for that ship endeavours to pursue whales until they are within close range. If there is therefore any such difference in the habits of Blue and Fin whales it does not seem sufficient to account for the estimated preponderance of Fin over Blue whales. It can be seen from Figs. 3, 5, 6, and 7 that the species ratio varies in different parts of the Antarctic, and the existence of such variations has been made clear enough by Hjort, Lie and Ruud. They point out (1934, p. 19) that the catch statistics do not provide a reliable means of estimating the proportions of Blue and Fin whales in the sea. Their figures, however, do give an indication of how those proportions vary in the different areas. Bergersen, Lie and Ruud (1939, p. 18) give a table showing the different species as a percentage of the total catch in each season since 1929–30. During these years the proportions have altered considerably, Blue whales decreasing heavily and Fin whales increasing. In almost every year, however, the percentage of Blue whales has been higher in areas III and IV than in area II, and the same may be said of Humpbacks. The averages of the percentage catch in each area for the whole period 1929–38 works out as follows:

Area...	II	III	IV	V (1929–31 only)
Blue	48·9	64·1	67·4	62·8
Fin	48·0	28·8	21·3	26·0
'Other' (mostly Humpback)	3·1	7·1	11·3	11·1

or for the four seasons 1934–8:

Area...	II	III	IV
Blue	38·5	45·5	57·2
Fin	57·8	42·0	25·2
'Other' (mostly Humpback)	3·7	12·5	17·6

These figures do not mean very much except that Blue and Humpback whales are disproportionately scarce in area II, which, as Hjort, Lie and Ruud have pointed out, is the oldest of the four whaling grounds.

Table 19 is derived from Table 12, p. 241, and shows for each area the number and percentage of each species shot at by the 'William Scoresby' (area I here being the new area in the Bellingshausen Sea and not Hjort, Lie and Ruud's small area I around the South Shetland Islands). Table 20 shows the proportions in which species have been observed, and is drawn up from the same data as Table 17 except that those seen north of 40° S (a small proportion) are omitted. It includes the provisional area VI to cover the central Pacific sector.

Table 19. *Ratio of species shot at by the 'William Scoresby' in separate areas*

Area...	I		II		III		IV		V		VI		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Blue	20	*4·8*	34	*3·6*	524	*17·8*	277	*23·4*	—	—	—	—	855	*15·5*
Fin	329	*79·1*	902	*94·0*	2252	*76·4*	246	*20·8*	—	—	—	—	3729	*67·7*
Humpback	67	*16·1*	23	*2·4*	172	*5·8*	662	*55·8*	—	—	—	—	924	*16·8*

Table 20. *Ratio of species by observation at sea in separate areas ('certain' and 'probable' identifications included)*

Area...	I		II		III		IV		V		VI		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Blue	40	*33·1*	49	*11·0*	40	*17·8*	8	*22·9*	18	*18·9*	12	*13·8*	167	*16·6*
Fin	72	*59·5*	394	*88·3*	179	*79·5*	25	*71·4*	36	*37·9*	75	*86·2*	781	*77·4*
Humpback	9	*7·4*	3	*0·7*	6	*2·7*	2	*5·7*	41	*43·2*	—	*0·0*	61	*6·0*

In these two tables the data, divided as they are into the separate areas, become too scanty for very reliable conclusions, and though the totals are not much different there are some obvious discrepancies in some areas. However, in areas II and III in which the number of whales observed and the number shot at are both fairly large, the proportions are not much different. In area IV the observed whales are so scarce as to be of little value. The whales shot at in area IV include a very high proportion of Humpbacks, but this is not necessarily representative of the real proportion, for if the 'William Scoresby' met with a sufficient concentration of them a special attempt might be made to mark as many of this species as possible, to the neglect of other species.

The interpretation of the data is thus subject to a good many qualifications, and with the available material we cannot make any very accurate estimate of the species ratio in the Southern Ocean as a whole, especially in view of the fact that the ratio has almost certainly been changing from year to year. In certain areas, however, an estimate can be made which should be reliable within certain limits.

In area II the data from whale marking and observation are as follows:

	Blue %	Fin %	Humpback %
Shot at by 'William Scoresby'	3·6	94·0	2·4
Marked at South Georgia	13·2	86·5	0·3
Observed by 'Discovery II', etc.	11·0	88·3	0·7

The quantity of data on which these figures are based can be seen from Tables 18–20. The South Georgia marking data apply to a very limited locality in area II, and are included here only because they seem to support the 'observed' data rather than the 'William Scoresby' data. The latter were acquired in the 1937–8 season, the marking at South Georgia covered the period 1932–7, and the 'observed' whales were logged at various times between 1926 and 1939, though not many of these identifications were made before 1930. There is reason to believe that the stock of Blue whales is being reduced more quickly than the stock of Fin whales (see p. 282), and this may at least in part account for the low percentage of Blues in the 'William Scoresby's' data which are in respect of a single recent season. It seems almost certain that in the last two or three years before the war the percentage of Blue whales in area II cannot have been less than 3 % or more than about 12 %. Humpbacks have a more patchy distribution, but the percentage of this species is clearly very low. In this area then it seems that of the combined population of Blue, Fin and Humpback whales the recent proportions are of the order of 9, 89 and 2 % respectively.

The whales shot at by the 'William Scoresby' in area II may be compared with the whales taken by whalers in the same area in the same season as follows:

	Blue %	Fin %	Humpback %
Shot at by 'William Scoresby'	3·6	94·0	2·4
Taken by whalers*	16·6	80·9	1·7

* Figures from Bergersen, Lie and Ruud (1939, p. 38).

The agreement here is quite good if allowance is made for the fact that the Blue whale is more valuable to the whalers than the Fin whale.

In area I there is clearly a higher percentage of Humpbacks than in area II, but the percentage in Tables 19 and 20 differ so widely that no reliance can be placed on them.

In area III the figures in Tables 19 and 20 agree very closely in respect of the Blue/Fin ratio. The percentages of Humpbacks do not tally very well, but for reasons given above the 'William Scoresby's' ratio of 5·8 % is much more likely to be correct than the 'observed' 2·7 %. In any case we know that Humpbacks are plentiful in at least a part of area III. In this area, then, there is reason to believe that the ratio of Blue, Fin and Humpback whales is of the order of 18, 76 and 6 % respectively.

For reasons given above the data for areas IV–VI are largely unreliable, though it would seem that there are rather more Blue and Humpback whales in IV than in III. Here the catch statistics (p. 264) are helpful, for in area IV they show larger catches of Blues and Humpbacks, and fewer catches of Fins than in area III.

The catch statistics for area V are not properly comparable with the other areas, for they cover only the two seasons 1929–31. At that time fewer Blue and more Fin and Humpback whales were taken in area V than in areas III and IV, but, on the other hand, very few whales have been taken there since 1931, and the local stock of Blue whales may not have been reduced so much in recent years as it has in areas II–IV.

In area VI no Humpbacks were identified during the voyages of the 'Discovery II' and this is to be expected, for it is far from any coastal waters to which this species might be expected to resort on its northward migration. As to the Blue/Fin ratio in area VI it can be said that the figures in Table 20 so far as they go suggest a higher proportion of Fin whales than in most other areas.

In Tables 17 and 18 (pp. 262–3) the total ratios by observation and marking suggested that there were about 13–14 % Blue, 76–79 % Fin and 7–11 % Humpbacks. It was mentioned that area II was unduly represented in these figures, and it is now evident that in that area the proportion of Fin whales is higher, and of Blue and Humpbacks lower, than the average for all areas. I should suggest that in the Southern Ocean as a whole, in, say, the year or two preceding 1939, the total population of Blue, Fin and Humpback whales might include 10–20 % Blue, 65–85 % Fin and 5–15 % Humpbacks. This is a tentative estimate, but it seems certain at least that the stock of Fin whales outnumbers the stock of Blue whales several times over.

SEX RATIO

There is no established means of distinguishing the sex of a whale in the water, except, for example, when a female is obviously accompanied by its calf. Consequently estimations of the sex ratio can be based only on statistics of catches and the ratio in foetuses. It is very difficult to say whether there are actually more of one sex than of the other, for there is clearly no great disparity, and an apparent preponderance of one sex might simply be the result of some degree of segregation. The foetal sex ratio should represent the relative numbers of each sex born, but it is not necessarily to be assumed that the two sexes survive in the same ratio to maturity.

Table 21. *Foetal sex ratio*

(From International Statistics and Discovery Committee's records)

	Season	Blue			Fin			Sei			Humpback		
		♂	♀	% ♂	♂	♀	% ♂	♂	♀	% ♂	♂	♀	% ♂
'Southern Seas'	1933–4	827	713	*53·7*	387	366	*51·4*	—	—	—	36	30	*54·5*
	1934–5	637	567	*52·9*	701	680	*50·8*	17	19	*47·2*	130	98	*57·0*
	1935–6	842	863	*49·4*	698	701	*49·9*	—	—	—	213	183	*53·8*
	1936–7	925	855	*52·0*	1066	948	*52·9*	3	5	*37·5*	250	191	*56·7*
	1937–8	1001	846	*54·2*	2177	1931	*53·0*	10	9	*52·6*	210	150	*58·3*
	1938–9	1142	977	*53·9*	1758	1641	*51·7*	2	3	*40·0*	146	80	*64·6*
	Total	5374	4821	*52·7*	6787	6267	*52·0*	32	36	*47·1*	985	732	*57·4*
'Discovery'	1925–31	54	70	*43·5*	180	145	*55·4*	33	21	*61·1*	5	4	*55·6*

Table 21 shows the ratios of the sexes of foetuses recorded in the International Statistics, and the sexes recorded by the Discovery Committee's staff are added. The latter figures are really too small to be of much assistance. From this table it is clear that there is no great difference in the numbers of each sex at birth. It seems almost certain, however, that in Humpbacks rather more males than females are born, and highly probable that in Blue and Fin whales also there are slightly more males. The figures for Sei whales are inconclusive.

Table 22 gives the numbers of each sex in different localities so far as they are recorded in the International Statistics, and here also the Discovery Committee's records are added. It will be seen that in the totals for all localities males predominate over females in Blue, Fin and Humpback whales. This might be caused by the absence of many of the lactating females from the main whaling grounds (see p. 223), but, on the other hand, we should expect some selection of females by the whalers on account of their larger size. The balance of probability is that there are in fact slightly more males, and this is supported by the foetal ratio. Records of the sexes of Sei whales are very scarce in the International Statistics. There appear to be more females in the catches, but the Sei is a small whale and hardly worth catching below a certain length. Consequently the selection of females is greater than in other species (for, as in other species, the female grows to a greater size than the male). Matthews (1938*c*, p. 187) shows that up to a length of 15 m. males are commoner than females, and concludes that there is actually an excess of males from early stages of foetal life.

It is probable then that in all four species there are slightly more males than females.

The sex ratio at different localities need not be discussed at much length, but certain important facts are shown by Table 22. In the Antarctic pelagic catches Blue and Fin whales always show an excess of males which usually form about 53–55 % of the total. At South Georgia also male Fin whales are slightly in excess of females, but it is curious that among Blue whales here the females appear always to predominate. Similarly, there is an excess of male Fin and female Blue whales in the winter catches at temperate

Table 22. *Sex ratio*

(From International Statistics, including summary of Discovery Committee's records)

Whaling centre	Season	Blue			Fin			Sei			Humpback		
		♂	♀	% ♂	♂	♀	% ♂	♂	♀	% ♂	♂	♀	% ♂
Congo	1935	—	—	—	—	—	—	—	—	—	722	519	*58·2*
	1936	—	—	—	—	—	—	—	—	—	367	473	*43·7*
	1937	—	—	—	—	—	—	—	—	—	165	133	*55·4*
	Total	—	—	—	—	—	—	—	—	—	1,254	1,125	*52·7*
West Australia	1936	—	—	—	—	—	—	—	—	—	2,138	934	*69·6*
	1937	—	—	—	—	—	—	—	—	—	2,071	1,171	*63·9*
	1938	—	—	—	—	—	—	—	—	—	517	400	*56·4*
	Total	—	—	—	—	—	—	—	—	—	4,726	2,505	*65·4*
Madagascar	1937	—	—	—	11	11	*50·0*	—	—	—	754	469	*61·6*
Walvis Bay	1930	98	128	*43·4*	40	20	*66·7*	—	—	—	—	—	—
Natal	1930	109	156	*41·1*	252	224	*52·9*	—	—	—	—	—	—
	1931	65	57	*53·3*	196	173	*53·1*	—	—	—	—	—	—
	1932	53	56	*48·6*	194	151	*56·2*	—	—	—	—	—	—
	1933	35	50	*41·2*	354	248	*58·8*	—	—	—	—	—	—
	1934	30	40	*42·9*	306	230	*57·1*	—		—	—	—	—
	1935	59	63	*48·4*	297	229	*56·5*	—	—	—	213	205	*51·0*
	1937	36	26	*58·1*	431	324	*57·1*	—	—	—	123	117	*51·2*
	1938	19	20	*48·7*	287	249	*53·5*	—	—	—	87	88	*49·7*
	Total	406	468	*46·5*	2,317	1,828	*55·9*	—	—	—	423	410	*50·8*
'Discovery', 1926,	1930	27	34	*44·3*	33	30	*52·4*	7	2	*77·8*	11	3	*78·6*
Saldanha Bay	1930	157	193	*44·9*	232	184	*55·8*	—	—	—	—	—	—
	1936	34	45	*43·0*	293	273	*51·8*	—	—	—	11	16	*40·7*
	1937	26	31	*45·6*	218	180	*54·8*	—	—	—	14	14	*50·0*
	Total	217	269	*46·4*	743	637	*53·8*	—	—	—	25	30	*45·5*
'Discovery'	1926	120	127	*48·6*	114	75	*60·3*	4	7	*36·4*	2	2	*50·0*
Peru	1936	68	67	*50·4*	79	60	*56·8*	—	—	—	—	—	—
	1937	45	22	*67·2*	58	39	*59·8*	—	—	—	—	—	—
	Total	113	89	*55·9*	137	99	*58·1*	—	—	—	—	—	—
South Georgia	1931–2	216	222	*49·3*	953	780	*55·0*	—	—	—	—	—	—
	1932–3	111	155	*41·7*	345	376	*47·8*	—	—	—	—	—	—
	1933–4	223	311	*41·8*	895	833	*51·8*	—	—	—	38	54	*41·3*
	1934–5	242	314	*43·5*	413	423	*49·4*	—	—	—	21	16	*56·8*
	1935–6	580	641	*47·5*	274	246	*52·7*	—	—	—	17	24	*41·5*
	1936–7	59	62	*48·8*	568	511	*52·6*	—	—	—	8	9	*47·1*
	1937–8	34	63	*35·0*	826	726	*53·2*	55	100	*35·5*	17	23	*42·5*
	1938–9	98	134	*42·2*	612	695	*46·8*	5	14	*26·3*	—	—	—
	Total	1,563	1,902	*45·1*	4,886	4,590	*51·6*	60	114	*34·5*	101	126	*44·5*
'Discovery'	1925–31	533	550	*49·2*	984	891	*52·5*	54	147	*26·9*	18	27	*40·0*
Antarctic, pelagic	1929–30	7,998	6,851	*53·9*	3,517	2,455	*58·9*	—	—	—	—	—	—
	1930–1	12,760	11,156	*53·5*	4,216	3,075	*58·5*	—	—	—	—	—	—
	1931–2	2,962	2,480	*54·4*	547	396	*58·0*	—	—	—	—	—	—
	1932–3	9,673	8,907	*52·1*	2,363	2,071	*53·3*	—	—	—	—	—	—
	1933–4	9,257	7,535	*55·1*	2,856	2,615	*52·2*	—	—	—	327	443	*42·5*
	1934–5	8,378	7,498	*52·8*	6,181	5,418	*53·3*	—	—	—	900	1,027	*46·7*
	1935–6	8,940	7,565	*54·2*	4,794	4,382	*52·2*	—	—	—	1,256	1,862	*40·3*
	1936–7	7,319	6,858	*51·6*	7,458	5,833	*56·1*	—	—	—	2,204	2,256	*49·4*
	1937–8	7,744	7,057	*52·3*	14,542	11,870	*55·1*	4	2	*66·7*	764	1,266	*37·6*
	1938–9	6,959	6,880	*50·3*	10,422	9,055	*53·5*	2	1	*66·7*	266	617	*30·1*
	Total	81,990	72,787	*53·0*	56,896	47,170	*54·7*	6	3	*66·7*	5,717	7,471	*43·4*
'Discovery'	1939–41	163	196	*45·4*	632	589	*51·8*	—	—	—	—	2	*(0·0)*
Grand total	1929–39	84,387	75,643	*52·7*	65,030	54,355	*54·5*	77	126	*37·9*	13,000	12,136	*51·7*

and tropical centres. More significant is the local variation in the sex ratio of Humpbacks. In each season there is a clear excess of females in the Antarctic pelagic catches, whereas in the tropics there is an excess of males which is specially marked off the west coast of Australia and, apparently, at Madagascar. There seems to be a definite segregation of the sexes here which is of some importance in relation to the effect of whaling on the stock of whales (see Table 30, p. 290). The explanation presumably lies in some difference in the migrations of the two sexes. Perhaps on the southward migration the males tend not to travel so far south as the females, or perhaps some of them remain in tropical waters during the summer. In the temperate waters of Natal the sexes are about equal, and at Saldanha Bay and South Georgia the figures are rather too small to be conclusive.

SEASONAL CHANGES IN THE LOCAL COMPOSITION OF THE STOCK

The term 'seasonal changes' refers here to regular changes which take place from month to month every year. The statistics of catches clearly show that in the course of the summer changes do take place in the make up of the whale population on the Antarctic whaling grounds, but it is not easy to give any precise account of them, for the available data are in many respects inadequate and unsatisfactory. The subject cannot be neglected, however, for it is closely concerned with the migrations and distribution of the different species and classes of whales, and with the effect of whaling on the stock.

It would be desirable to compare in each month the ratio of species and sexes, the average length, the percentage of immature, pregnant, resting and lactating whales, and even the average age. The International Statistics give abundant data on the species ratio in each month, but little else. Hjort, Bergersen, Lie and Ruud analyse the catch statistics in respect of the monthly species ratio and output of oil per Blue whale unit, and for the season 1934–5 give the monthly percentage of sexually mature and immature whales (1935, p. 21). For some information on fluctuations in average length and the incidence of different classes of whales I have the Discovery Committee's records of whales examined at shore stations and in factory ships, and some records of the catches of one or two factory ships made by whaling inspectors.

From such data inferences must be drawn with caution for, as already pointed out (p. 228), the catches of whales are not necessarily representative of the composition of the stock, and any changes in the catches of factory ships may result not only from changes in the composition of the stock but also in part from changes in the locality in which the ship is working. In this respect data from the land stations at South Georgia may be a little more reliable, though even there the catchers do not necessarily work quite the same area throughout the season (see Kemp and Bennett, 1932).

THE MONTHLY SPECIES RATIO

It is well known that comparatively few Fin whales appear in the Antarctic catches in the early part of the summer, and comparatively few Blue whales in the later part. The International Statistics (no. VII, pp. 5–8, and no. XIV, pp. 7–8 and 13–14) give for each month in each of the twelve seasons 1927–39 the catch of each species, both in absolute and percentage figures. In recent years pelagic whaling has been restricted to the period November–March, and at South Georgia from October to April. In earlier years, however, whaling sometimes began in September and lasted into May. For a concise indication of the changes which take place in the species ratio I have included in Table 23 (derived from the International Statistics) the percentage for each month in the whole period 1927–35. From 1935 onwards, hardly a whale was taken before the beginning of November or after the end of March, and separate figures are therefore shown for 1938–9 which is the most recent season for which I have particulars. Table 23 (*a*) is based on a total of 159,674 whales, and (*b*) on 36,665 whales. The figures for September are based on very few whales. Those for May are misleading, for here most of the whales were Sei and may have been taken on the way home after the ships had left the normal whaling grounds. It is therefore not to be supposed that the May figures have much to do with the species ratio on the Antarctic grounds.

Table 23. *Antarctic pelagic catches. Monthly percentage of each species*

	Total catch					Per cent				
	Blue	Fin	Sei	Hump-back	Sperm	Blue	Fin	Sei	Hump-back	Sperm
	(*a*) Eight seasons, 1927–35									
September	74	3	—	3	—	(92·5)	(3·7)	—	(3·7)	—
October	6,772	739	—	57	21	89·2	9·7	—	0·8	0·3
November	23,570	1,910	2	698	449	88·5	7·2	—	2·6	1·7
December	32,718	3,749	2	1,456	334	85·5	9·8	—	3·8	0·9
January	23,081	11,222	67	1,068	454	64·3	31·3	0·2	2·9	1·3
February	14,814	14,580	228	773	127	48·6	47·8	0·7	2·5	0·4
March	7,644	9,309	395	201	25	43·5	53·0	2·3	1·1	0·1
April	644	1,782	322	6	—	23·4	64·7	11·7	0·2	—
May	5	37	326	2	—	(1·4)	(10·0)	(88·1)	(0·5)	—
	(*b*) Recent season, 1938–9									
November	846	64	—	134	309	62·5	4·7	—	9·9	22·9
December	5,124	3,605	—	456	953	50·5	35·6	—	4·5	9·4
January	4,899	6,959	—	235	533	38·3	55·1	—	1·9	4·2
February	2,368	7,061	—	58	499	23·7	70·7	—	0·6	5·0
March	602	1,788	3	—	168	23·5	69·8	0·1	—	6·6

Table 24 shows the South Georgia catches during the same period. The statistics show only four whales taken in May since 1927, and this month is therefore omitted.

It is clear from Table 23 that in the Antarctic the proportion of Blue whales caught declines while that of Fin whales increases. The International Statistics show that this invariably takes place in every season, and there is no doubt that it represents a real change in the species ratio in the whale population. The figures for Sei whales are of doubtful significance for this species does not usually migrate into very cold water, and it is difficult to know whether any substantial number were taken on the normal grounds. Most Humpbacks are taken in December, January and February. A high percentage appears in November 1938, but the actual numbers taken in December and January were higher. It is not clear whether the figures for Sperm whales include some catches outside the normal whaling grounds.

Table 24. *South Georgia catches. Monthly percentage of each species*

	Total catch					Per cent				
	Blue	Fin	Sei	Hump-back	Sperm	Blue	Fin	Sei	Hump-back	Sperm
	(*a*) Eight seasons, 1927–35									
September	35	195	—	—	7	14·8	82·3	—	—	2·9
October	752	1348	1	2	15	35·5	63·7	—	0·1	0·7
November	1601	1930	3	10	19	44·9	54·2	0·1	0·3	0·5
December	1768	2919	—	75	6	37·1	61·2	—	1·6	0·1
January	1291	3714	16	90	18	25·2	72·4	0·3	1·8	0·3
February	361	2136	236	54	37	12·8	75·6	8·4	1·9	1·3
March	203	879	474	11	76	12·4	53·5	28·8	0·7	4·6
April	36	208	108	4	29	9·4	54·0	28·1	1·0	7·5
	(*b*) Recent season, 1938–9									
October	—	51	—	—	—	—	100·0	—	—	—
November	7	232	—	—	1	2·9	96·7	—	—	0·4
December	131	318	—	—	4	28·9	70·2	—	—	0·9
January	35	292	—	—	5	10·5	88·0	—	—	1·5
February	24	189	—	—	5	11·0	86·7	—	—	2·3
March	32	211	13	—	87	9·3	61·5	3·8	—	25·4
April	3	14	6	—	15	7·9	36·8	15·8	—	39·5

At South Georgia (Table 24) Blue whales again become scarce towards the end of the season, but there is no steady change in the proportion of Fin whales. The figures in this table are really misleading, for, as Harmer has shown (1931, p. 131), conditions there vary a good deal from year to year. In some whaling seasons the maximum catches of Blue whales precede the maximum catches of Fin whales, while in other seasons the Fin maximum comes first. Harmer found as a general rule that, in those seasons in which the mean September air temperature at South Georgia was less than 32·5° F, the maximum catch of Blue whales preceded that of Fin whales, while, in seasons in which the temperature exceeded 32·9° F, the Blue whale maximum was later than that of Fin whales. He suggests that the explanation is that in general the principal concentration of Fin whales lies rather to the north of that of Blue whales (though of course the two species overlap). Thus in a cold season the Blue whale concentration might lie at first in the latitude of South Georgia while the Fin whales were farther north, and as the season advanced both species would move south, and the Fin whale maximum would therefore follow the Blue. In a warmer season the Fin whale maximum would be nearer to the island at the beginning of the season, and this would be reflected in the catches. To explain the later Blue-whale maximum Harmer postulates a northward movement of some of the Blue whales. He also says: 'The immature individuals, probably arriving from the north, which make their appearance at about the New Year, are probably also important in this connexion.'

At all events it is clear that on the Antarctic whaling grounds as a whole the major part of the Fin-whale stock makes its appearance later than the Blue whales. South Georgia occupies a peculiar position where Antarctic conditions extend into a comparatively low latitude, and Fin whales may be plentiful there before they have reached the higher latitudes elsewhere. It is not until about the New Year that the big herds of Fin whales make their appearance on the pelagic grounds.

The largest numbers of Humpbacks are taken in mid-season, December and January, both on the pelagic grounds and at South Georgia.

THE MONTHLY SEX RATIO

It has been shown above that a large body of data indicates a slight excess of males over females. If the sex ratio is compared month by month there is a certain amount of irregular variation, but a very large number of records would be needed to demonstrate with certainty any definite differences in the movements and distribution of the sexes.

The numbers of each sex caught month by month are not given in the International Statistics. I have particulars, however, of the catches of four factory ships, one in which Mr A. H. Laurie worked in the season 1932–3, and three in which Commander H. Buckle sailed as Whaling Inspector in 1934–5, 1935–6 and 1936–7. Dr F. D. Ommanney in 1939–40 and Mr P. R. Crimp in 1939–40 and 1940–1 examined a considerable number of whales in factory ships, and these were a random sample of the total catches. For South Georgia there are the Discovery Committee's data. With this material the monthly sex ratios are shown, again as percentages of males, in Table 25. Humpbacks examined at South Georgia and by Laurie, Ommanney and Crimp in factory ships were too few for the monthly figures to be of any value here, and are therefore omitted. A few whales examined at South Georgia in September and May are also omitted.

The 'Southern Princess' data show a reduction in the percentage of male Blue whales in February and March. As explained on p. 223 this probably results from the late arrival in high latitudes of females which were lactating (or which had recently weaned their calves), the catching of which had not yet been prohibited in 1932–3. The figures for Fin whales are inconclusive.

The sex ratio of Blue whales taken by the 'Southern Empress' fluctuates a little, but shows no definite trend. In 1934, however, the catching of females with their calves was no longer allowed. Male Fin whales seem to increase a little in the later months, and there is a distinct increase in the ratio of male Humpbacks, but it is difficult to know whether any significance should be attached to it.

Table 25. *Monthly sex ratio*

	'Southern Princess', 1932–3 (Laurie)				'Southern Empress', 1934–7 (Buckle)					
	Blue		Fin		Blue		Fin		Humpback	
	Total whales	% males	Total whales	% males	Total whales	% males	Total whales	% males	Total whales	% males
October	67	56·7	—	—	150	54·7	—	—	—	—
November	348	58·6	—	—	374	50·3	—	—	—	—
December	438	63·9	4	(25·0)	1012	56·5	65	49·2	350	36·0
January	450	58·9	37	(21·6)	876	47·3	121	49·6	383	37·1
February	219	50·7	150	45·3	758	53·3	249	49·0	281	49·5
March	176	34·7	111	48·6	370	50·5	213	54·0	16	(50·0)
April	—	—	—	—	26	(30·8)	34	(58·8)	—	—
Total	1698	56·5	302	43·4	3566	52·0	682	51·2	1030	40·3

	Ommanney & Crimp, 1939–41				South Georgia, 1925–31			
	Blue		Fin		Blue		Fin	
	Total whales	% males	Total whales	% males	Total whales	% males	Total whales	% males
October	—	—	—	—	36	(52·8)	117	53·8
November	—	—	—	—	195	50·8	194	45·9
December	103	46·6	165	49·7	242	54·1	261	46·4
January	161	46·6	397	53·1	263	47·9	565	60·2
February	79	36·7	448	50·1	143	44·1	379	54·4
March	16	(68·7)	211	54·0	156	46·8	259	47·1
April	—	—	—	—	38	(50·0)	88	43·2
Total	359	45·5	1221	51·8	1073	49·4	1863	52·5

The numbers of Blue whales examined in 1939–41 are hardly sufficient for any definite conclusions, and Fin whales fluctuate irregularly.

At South Georgia there is some indication of a diminishing proportion of male Blue whales, and this again may be due to the late arrival of non-breeding females. In Fin whales the high proportion of males in January has a definite significance, for the same phenomenon has been a feature of several separate seasons. In 1925–6 for instance Fin whales were at first very scarce around South Georgia. About the end of December there was a sudden incursion of this species; during January they were caught in exceptionally large numbers, the great majority at first being males. In six days the Fin whales examined by the Discovery Committee's staff included forty males and only thirteen females, and the number of males examined in January was twice the number of females. This was clearly an instance of at least partial segregation of the sexes. In 1928–9 and 1929–30 again there was a large influx of Fin whales about the New Year, and again in January the number of males examined was nearly twice the number of females. It seems likely that the vanguard of the main herds of Fin whales which arrive on the whaling grounds at this time of year is composed mainly of males, at least in the South Georgia district. As in Blue whales, however, the females are in excess of males towards the end of the season.

Apart from these features it cannot be said that the data indicate any important differences in the sex ratio in different months in the Antarctic as a whole. Some irregular fluctuations take place which may be caused by more than one factor and which cannot be explained from the available material.

MONTHLY AVERAGE LENGTHS AND PERCENTAGE OF IMMATURE WHALES

Both at South Georgia and on the pelagic whaling grounds the proportion of small immature whales in the catches increases in the later part of the summer season. Mackintosh and Wheeler (1929, pp. 456–60) found evidence of this in the earlier data collected at South Georgia, and from the numbers of corpora lutea in the ovaries inferred (pp. 460–61) that, of the adult whales, those taken early in the season were mostly older than those taken later. Wheeler (1934, p. 235 and fig. 1) showed that, of the Fin whales examined at South Georgia, 'the majority of physically mature females appeared in December, the majority of sexually mature not physically mature females in January and the peak of the influx of immatures was in February'. This increased proportion of young whales in late summer is less obvious in the Antarctic pelagic catches, but Hjort, Lie and Ruud (1935, p. 21) give the monthly percentages of mature and immature Blue whales taken in area III in the season 1934–5, and show that there is a distinct increase in the ratio of immatures from December to March. Ottestad (1938) gives preliminary length-frequency curves for each month for Blue whales in 1932–3 in areas III and IV and for Fin whales in 1934–5 in areas II–IV. These curves also show an increasing proportion of small whales in the later months, but the tendency is more noticeable in area III than in areas II and IV. He concludes that this is due to the later arrival of small whales and probably also to the departure of some of the larger ones.

In Table 26 the material from the 'Southern Empress' is analysed in respect of the monthly average length and percentage immature, and corresponding figures are given for the South Georgia data, though Humpbacks were too few to be included in the latter. The same figures are graphed in Fig. 9. The percentage immature is calculated from the revised mean lengths at maturity (see p. 219). If the original lengths were used the percentages of immature Blue females and Fin males and females would mostly be about 2–5 % higher. It will be recalled that the mean length at which Humpbacks become mature was estimated on a rather small amount of data, but even if this length needed some correction the rate of change from month to month in the ratio of immature whales would hardly be affected. The table shows that in each species and sex the tendency is towards a fall in the average length and an increase in the percentage immature as the season advances. This change is more marked at South Georgia than in the catches of the 'Southern Empress' which were in area IV, and it seems more evident in Blue than in Fin whales. There is very little change in the average lengths of Humpbacks, but there is a distinct rise in the percentage immature. The curves for South

Table 26. *Monthly average lengths (in feet) and percentage immature*

(*a*) Southern Empress, 1934–7 (Area IV)

	Blue						Fin						Humpback					
	Males			Females			Males			Females			Males			Females		
	No.	Av. length	% imm.	No.	Av. length	% imm.	No.	Av. length	% imm.	No.	Av. length	% imm.	No.	Av. length	% imm.	No.	Av. length	% imm.
October	82	78·5	15·9	68	82·7	19·1	—	—	—	—	—	—	—	—	—	—	—	—
November	188	80·1	10·1	186	84·3	10·2	—	—	—	—	—	—	—	—	—	—	—	—
December	572	78·5	18·0	440	81·3	27·3	32	70·5	0·0	33	70·2	15·2	126	40·4	23·8	224	43·2	25·4
January	416	78·5	19·2	462	80·9	29·0	60	66·9	20·0	61	70·9	18·0	142	40·4	31·7	241	42·3	31·9
February	404	77·5	26·0	354	80·5	33·9	122	68·2	10·7	127	71·2	10·9	139	40·2	34·5	142	42·5	37·3
March	187	77·6	26·7	183	80·3	36·1	115	67·7	13·0	98	70·0	18·4	8	(38·1)	(75·0)	8	(41·9)	(37·5)
April	8	(73·5)	(37·5)	18	(73·3)	(66·7)	20	65·0	30·0	14	(67·6)	(28·6)	—	—	—	—	—	—

(*b*) South Georgia, 1925–31

	Blue						Fin					
	Males			Females			Males			Females		
	No.	Av. length	% imm.	No.	Av. length	% imm.	No.	Av. length	% imm.	No.	Av. length	% imm.
October	19	74·7	47·4	17	79·2	31·2	63	66·5	25·4	54	68·6	24·1
November	99	74·8	38·4	96	78·1	35·8	89	65·6	18·0	105	69·8	15·2
December	130	77·2	26·0	111	77·5	38·7	121	65·1	28·1	140	69·7	18·6
January	126	73·3	44·8	137	78·0	43·1	339	65·3	25·6	225	68·0	30·7
February	60	69·9	63·3	80	71·7	63·7	206	63·8	30·2	173	66·0	44·5
March	76	67·9	78·9	83	73·6	50·6	122	61·9	50·0	136	65·5	46·0
April	19	70·9	57·9	19	69·9	68·4	38	64·1	39·5	50	67·7	33·3
May	3	(73·2)	(33·3)	5	(85·5)	(0·0)	5	(63·7)	(40·0)	5	(63·7)	(60·0)

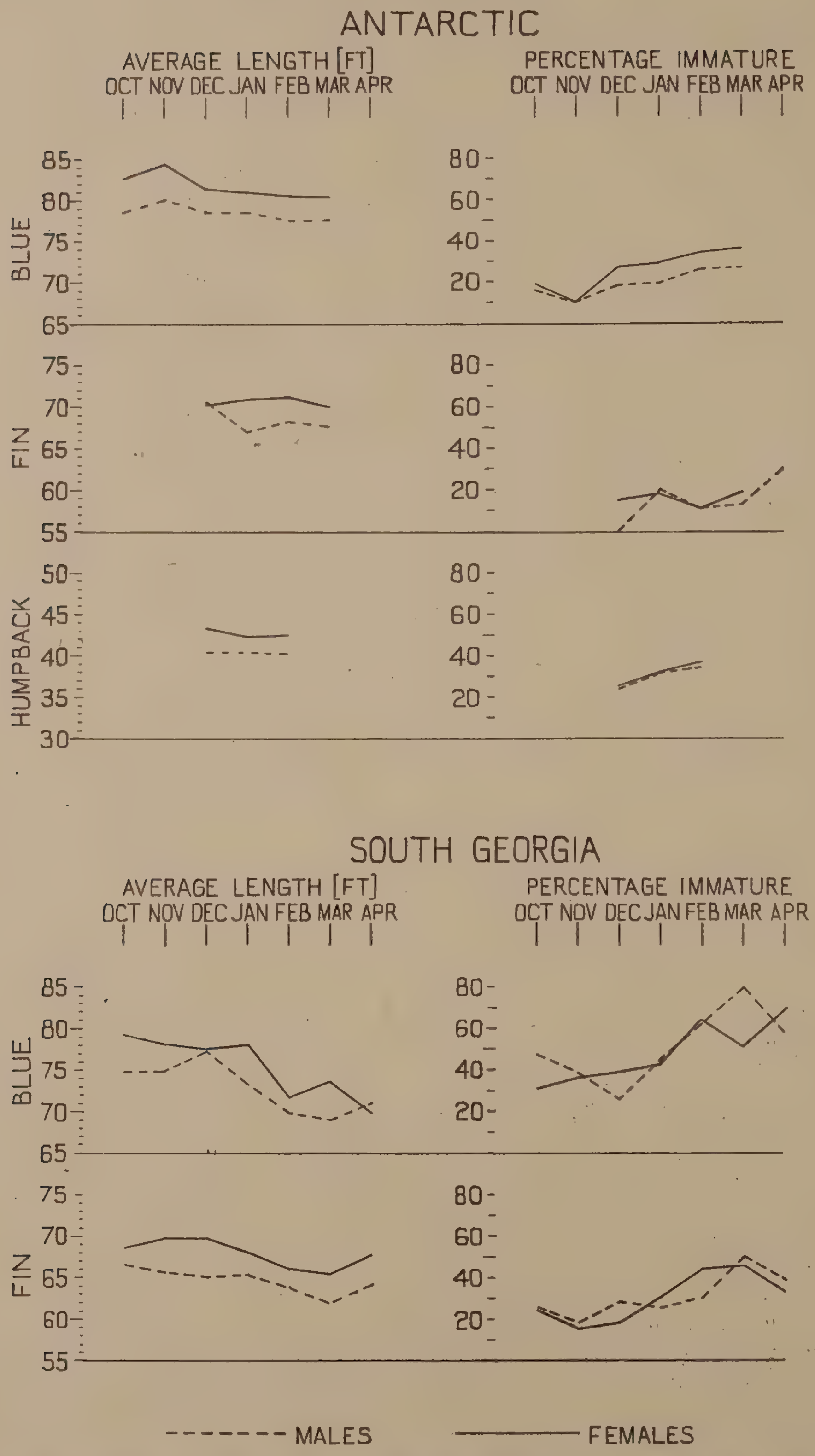


Fig. 9. Monthly changes in average length and percentage immature. Note that the vertical scale of the curves of average length covers a relatively small part of the total length.

Georgia suggest that some of the larger whales return (or small whales move elsewhere) at the end of the season, but reliable inferences cannot be drawn from such details unless they can be shown, with adequate data, to be regular features in a series of whaling seasons. Table 26 cannot give more than a rough indication of the changes which take place, especially as the figures are a combination of several seasons which do not always cover quite the same period of months. The fact that there is usually a sharp fall in the average lengths in the last month of the season may result from a scarcity of whales (which would restrict selection of the larger ones), as much as from a real fall in the average length in the population.

THE MONTHLY PERCENTAGE OF PREGNANT FEMALES

There is a marked change in the summer season in the percentage of adult females which are pregnant. Mackintosh and Wheeler (1929, p. 460) noted a higher percentage of pregnant females in the early part of the South Georgia season than in the later months, and Laurie's data from pelagic grounds (1937, p. 242) show the same effect. The extent of the change from month to month can be seen in Table 27. The Antarctic pelagic figures are based mainly on collections of ovaries made on various parts of the pelagic whaling grounds in the seasons 1934–5 to 1938–9. (They are derived only from a preliminary analysis of the data on ovaries and may subsequently need some slight adjustment. To this extent the table is a provisional one and is intended only to show that there is a marked change in the monthly percentages.) The pelagic figures also include the whales examined by Laurie in 1932–3, Ommanney in 1939–40 and Crimp in 1939–40 and 1940–1. The columns headed 'No.' show the total number of mature ovaries or the total number of adult females examined for pregnancy. The percentage pregnant is calculated on the assumption that when the ovaries provide the only evidence, the presence of a functional corpus luteum indicates that the whale was pregnant.

Table 27. *Percentage of adult females pregnant*

	Antarctic pelagic 1932–41				South Georgia 1925–31			
	Blue		Fin		Blue		Fin	
	No.	% P.	No.	% P.	No.	% P.	No.	% P.
September	—	—	—	—	1	*(0·0)*	1	*(100·0)*
October	24	*70·8*	—	—	12	*(33·3)*	40	*85·0*
November	117	*82·1*	—	—	59	*67·8*	86	*77·9*
December	916	*70·7*	51	*92·2*	53	*52·8*	111	*82·0*
January	753	*66·9*	122	*79·5*	69	*52·2*	134	*70·1*
February	451	*57·9*	148	*77·0*	24	*33·3*	81	*49·4*
March	201	*51·2*	67	*76·1*	37	*21·6*	65	*32·3*
April	2	*(100·0)*	—	—	6	*(50·0)*	30	*26·7*
May	—	—	—	—	3	*(0·0)*	2	*(50·0)*
Total	2464	*66·2*	388	*79·6*	264	*47·9*	550	*64·9*

As Laurie points out (1937, p. 232) this is likely to result in a few whales being included which have recently ovulated without becoming pregnant. In 100 ovaries with functional corpora lutea, however, there were only four in which he could find no foetus, and it is not impossible that even in these a small foetus was present. Thus the percentage may be a little too high but should be very nearly correct. In both the pelagic figures and those from South Georgia a number of seasons are combined which are not perhaps strictly comparable, for they do not always cover quite the same period of months, and there is some evidence that the percentage pregnant has altered from year to year (see p. 223). The calculated percentages, however, must be reliable at least as a rough indication of the change which takes place. It is noteworthy that the catching of females accompanied by calves was prohibited during most of the period covered by the pelagic data, but not during the period covered by the South Georgia data.

The table shows that there is a substantial decline in the percentage of pregnant females in the catches of both species on the pelagic grounds and at South Georgia, and this must reflect a real change in the composition of the population. This must imply an increasing proportion of resting whales, though at South Georgia it may be balanced partly by an increase in lactating females. It is difficult to know whether the decline is primarily attributable to earlier departure of pregnant females from the whaling grounds, or later arrival of other adult females.

THE STOCK OF WHALES

EVIDENCE OF THE DEPLETION OF THE STOCK

Since no direct method has yet been found for making reliable estimates of the actual numbers of whales in the southern populations the effect of whaling on the stock must be mainly judged by changes in the size and composition of the catches. It is generally admitted that the stocks at least of Blue and Humpback whales have substantially declined, and the evidence for this is to be found in the observed scarcity of certain species, in the absolute or relative reduction in the catches, and in the reduced sizes and ages of the whales caught.

The statistics of the Antarctic catches have been exhaustively studied from year to year by Hjort, Bergersen, Lie and Ruud. They point out that differences in the catches between one year and another are the result not only of changes in the stock, but also of changes in the number and efficiency of the ships, in the limits of the whaling season, in the regulations protecting certain classes of whales, in weather conditions, etc., and they show that the best method of comparing the catches at different times and in different places is to calculate the catch per catcher's day's work, a figure which eliminates at least some of the variable factors. They discuss the significance of progressive changes in the composition of the catches, and reference should be made to their series of articles for a general commentary on the prospects of the whaling industry year by year in relation to the stock of whales.

Perhaps the most convincing evidence of the decline of the Blue-whale stock is to be found in the reduction of the Antarctic catches of this species relative to the catches of others, in spite of the fact that it is the most profitable species. This is partly due to the fact that in recent years the prescribed whaling season has not begun before December, while most Blue whales are found in the early part of the season. But in the International Statistics it is pointed out that the same reduction is apparent in the catches for separate months. Since the opening and closing dates of the season have varied a little in recent years in December and March respectively, January and February are the only two months in which the percentage of each species caught is comparable year by year. The figures for these months in the twelve years preceding the war are shown in Table 28, and they are extracted from the International Statistics. In the earlier years there were considerable fluctuations in the proportion of Blue whales in the catches, but on the whole it increased to a maximum in 1931–2. Hjort, Lie and Ruud (1935, p. 26) attribute this to the extension of whaling to new grounds. Since 1931–2 there has been a heavy decline, the ratio in each season nearly always being substantially lower than in the preceding season. There was a slight increase in 1938–9, but it is to be supposed that this is of no more significance than the temporary increase in January 1935 and February 1936. Whatever the catching capacity of the fleet, the methods of the industry, or the areas in which the whaling has been conducted, it seems impossible to explain so striking a change except on the grounds of a significant reduction of the Blue-whale population. As Hjort, Lie and Ruud point out however (1935, p. 36), the decline in the catches is not a reliable *measure* of the decline in the stock. It is simply evidence that substantial depletion has taken place.

Table 28. *Annual percentage of each species in the Antarctic pelagic catches, January and February*

Season	January				February			
	Blue	Fin	Hump-back	Others	Blue	Fin	Hump-back	Others
1927–8	62·2	32·9	—	4·9	23·4	58·1	—	18·5
1928–9	79·1	20·7	0·1	0·1	49·9	49·6	0·1	0·4
1929–30	48·0	45·5	6·4	0·1	51·1	46·9	2·0	—
1930–1	65·0	33·2	1·7	0·1	62·5	37·0	0·5	—
1931–2	88·0	9·5	2·5	—	60·3	38·4	1·3	—
1932–3	81·1	17·2	0·6	1·1	50·8	48·4	0·7	0·1
1933–4	56·3	36·6	2·3	4·8	45·7	50·9	1·4	2·0
1934–5	58·8	34·5	5·8	0·9	36·0	55·8	7·6	0·6
1935–6	50·7	37·8	10·7	0·8	45·3	43·9	10·3	0·5
1936–7	45·2	37·7	15·7	1·4	27·1	61·4	10·4	1·1
1937–8	31·3	64·5	3·6	0·6	16·1	79·7	3·7	0·5
1938–9	38·8	55·1	1·9	4·2	23·7	70·7	0·6	5·0

Bergersen, Lie and Ruud (1939, p. 17) stress the fact also that the *absolute* numbers of Blue whales caught has not increased in spite of the increased activity of the fleet in recent seasons.

The same authors have given much attention to changes in the average size and the percentage of immature whales in the yearly catches of Blue and Fin whales. Although the average sizes of immature and mature Blue whales calculated separately has remained more or less constant, the proportion of immature whales in the catches has shown a significant increase, and for this reason the average size of all Blue whales has declined. The percentage of immature Blue whales, according to Bergersen, Lie and Ruud's figures, increased from 15·9 % in 1930–1 to 36·3 % in 1935–6. This increase was arrested in subsequent years, but would no doubt have continued had it not been for the imposition of minimum lengths below which whales could not be taken. In the same period the average length of immature and mature whales combined declined from 78·6 to 76·6 ft. in males and from 82·4 to 79·0 ft. in females. This must be the result of a reduction of the stock of Blue whales. It can be inferred that the average age of the catch has declined, but it does not follow with certainty that the average age of the stock has declined, for if Blue whales are scarcer there may be less selection of the larger (and on the whole older) individuals. The Norwegian authors emphasize that a fall in the average length of the mature whales would be of greater significance. Changes in the composition of the catches must in any case be interpreted with caution, for as Ottestad (1938) has pointed out, they may arise in part as a result of fluctuations in the year classes of whales. However, when the data from the Discovery Committee's collections of ovaries, which cover a number of years, have been fully worked out (see p. 216) it should be possible to decide whether there has in fact been a reduction in the average age of the adult whales, for this would be reflected in the yearly average numbers of corpora lutea in the females, proper allowance being made for the locality and time of year in which the specimens were obtained. In adult whales length is only in a small degree indicative of age (see p. 225), and it seems quite possible that the average age of mature whales could undergo a reduction without any change in the average length of mature whales.

Although we are not yet in a position to make a quantitative estimation of the rate at which the stock of Blue whales has been reduced, it seems at least certain that depletion has gone far enough already to have an important effect on the whaling industry, even though the level of production has perhaps been maintained by larger catches of other species and by technical improvements.

For a detailed comparison of the signs of depletion in the separate areas reference should again be made to Hjort, Bergersen, Lie and Ruud, who have shown that the percentage of Blue whales in the catches has declined to a lower point in area II (16 % in 1937–8) than in areas III and IV in which whaling has not been conducted for so long. Similarly, the percentage of immature Blue whales was at first highest in area II; but in later years area II was overtaken in this respect, first by area III and then by area IV as the intensity of whaling spread eastwards.

There seems to be no obvious indication that the stock of Fin whales has yet been seriously affected by the whaling industry, though there appears to be a tendency for the percentage of immature whales to increase if the yearly figures are considered separately for each area. This species, as we have seen, is, and possibly always has been, more abundant than the Blue whale, but it has been caught in increasingly large numbers owing to the scarcity of Blue whales, and it is not to be supposed that it could long withstand the pre-war intensity of whaling without showing signs of depletion, especially as it is necessary to take two Fin whales to equal the yield from one Blue whale.

It is certain that the stocks of Humpbacks have suffered severely from hunting. This species is more easily approached than other species, and its habit of concentrating in certain regions, especially off the continental coasts in winter, make it more than ever vulnerable. The effects of hunting do not perhaps become manifest in quite the same way as, for example, in Blue whales. It has been shown above that the Humpbacks are divided into much more clearly separated communities than Blue whales, and hence, rather than a general decline in numbers, we should expect heavy local depletion in regions where Humpbacks are taken in large numbers, while the species may still be abundant enough in other localities. Thus, as is well known, the Humpbacks were heavily depleted in the South Georgia region in the early years of the southern whaling industry, while they were subsequently found to be still abundant in areas III and IV when the activities of factory ships spread to the Indian Ocean sector of the Antarctic.

The destruction of the stocks of Humpbacks has been described among others by Matthews (1937, p. 82), who points out that, wherever new whaling grounds have been opened up, the Humpback has always been the predominant species in the first few years, and then rapidly declined in numbers. This certainly applies to the industries at South Georgia, Natal, the Congo, and Angola (see Table 10, p. 234), though some of these places have shown a partial recovery. Off Western Australia the stocks appear to have survived the fishing in 1912–15 and 1925–8, but it could not be expected that the populations here and off Madagascar could have maintained their numbers for long against the slaughter that was going on in 1936, 1937 and 1938, especially as the same stocks were being attacked in areas III and IV in summer in the Antarctic.

However, at the International Conference of 1938 it was agreed to prohibit the catching of Humpbacks by factory ships in the Antarctic for a year in the first place; and the reduced intensity of whaling in war time will also relieve the situation.

RELATIVE DEPLETION OF DIFFERENT SPECIES

It was tentatively estimated above (p. 266) that the ratio of the stocks of Blue, Fin and Humpback whales in the Southern Ocean is of the order of 15, 75 and 10 % respectively. The Humpback ratio is the most doubtful of the three, but it is certain that there are far more Fins than either Blues or Humpbacks, and it is probable that Humpbacks are slightly scarcer than Blues. For this reason alone we might expect that if whales need protection at all these two latter species need it. It has been shown that they have in fact suffered substantial depletion, and there is every reason to suppose that this depletion would be progressive (so long as the catching capacity of the industry was maintained) until a point was reached at which it was no longer worth while to hunt them. This point has not yet been reached except in case of Humpbacks in certain localities, and of course there has been a substantial reduction in the intensity of whaling in war time. We have to keep in mind, however, the likelihood of the resumption of intensive whaling after the war. It is sometimes argued that since whaling would cease when the stocks were reduced below the economic level, they could never approach extermination. It must be remembered, however, that so long as there are enough Fin whales to keep the whaling fleet at sea the scarcer species might continue to be caught from time to time until they were reduced almost to vanishing point.

Further evidence that the Humpback and Blue whales are the species most in need of protection is supplied by Rayner (1940, pp. 273–4), who states that the number of marks recovered from each species expressed as a percentage of the number of that species which have been marked, is 4·94 % in Blue, 3·01 % in Fin and 6·59 % in Humpbacks. Although the number of marked whales killed must be higher than the number of marks actually recovered, the percentage of marks returned must be more or less comparable between the three species. The fact that the rate of recovery of marks from Blue whales is higher than from Fin whales, and that the rate of recovery from Humpbacks is higher than from Blues, can only mean that Blue whales have been losing a bigger fraction of the stock on the whaling grounds than have Fin whales, and that Humpbacks have been losing an even bigger fraction than Blue whales. Thus not only is depletion more evident in Blue than in Fin whales, but the *rate* of depletion must have been greater in Blue whales and greater still in Humpbacks.

In view of the local heavy declines in the catches of Humpbacks, of the greater vulnerability of this species and its high relative rate of loss, it can hardly be doubted that this is the species most in need of protection, even though it is of less economic importance than the other two, and this was recognized at the International Conference referred to above.

PROSPECTS OF ESTIMATING THE ABSOLUTE MAGNITUDE OF THE STOCK

No method has yet been found for making any reliable estimate of the absolute magnitude of the stock of whales in the Southern Ocean, and although the problem seems to present almost insuperable difficulties it is by no means hopeless. There are several possible methods of gaining at least a clue, and although the data are at present inadequate for any useful calculations to be made, the matter is of sufficient importance for the prospects at least to be considered.

In the first place there is the method of direct observation. If we know the approximate limits say of the zone inhabited by whales in summer in the southern part of the Southern Ocean, and if all whales seen are counted from a ship making a sufficient number of random cruises through this zone, the number of whales counted should bear the same relation to the whole stock as the area of the belt of ocean viewed from the ship bears to the whole zone populated by the whales. A considerable body of such data has been accumulated by the Discovery Committee's ships, but an estimate on this basis would be unreliable in itself, mainly because of the extreme difficulty of making due allowance for changing conditions of visibility, and hence of calculating the area fairly viewed. Quite subtle atmospheric changes may make a great difference to the number of spouts observed.

In the second place the recoveries of whale marks might provide an independent line of inquiry. If m equals the number of marked whales at large in a given area at the beginning of the whaling season, m_k the number of marked whales killed in the same area during the same season, t the total whales killed in the same area during the same season, and S the total number (to be ascertained) of whales at large in the same area, etc., then it might be argued that

$$S = \frac{m \times t}{m_k},$$

on the ground that the ratio of marked whales killed to marked whales at large is as the ratio of total whales killed to total whales at large. The difficulty is to assign proper values to these symbols. The marked whales at large (m) might be calculated from markings in previous seasons less previous recoveries, on the assumption that the whales return to the same area after their winter migration; but we do not know what wastage of marks may have taken place, for a certain number must, for example, drop out of the whale. The marked whales killed (m_k) must be greater than the actual number of marks recovered, for some marks must be overlooked or not sent in. It should be possible to ascertain the number of whales killed (t), but the shifting nature of the population and uncertainty of the limits of the area under consideration make it doubtful whether m and t would be fair samples of S and properly comparable with each other. It might be possible to apply such a calculation to one of the self-contained groups of Humpbacks, but the unknown variables would still make such an estimate unreliable in itself.

Hjort, Jahn and Ottestad (1933) have discussed the possibility of estimating the magnitude of the stock of whales by a statistical method developed by Helland (1913–14). This method assumes a relation between the stock and the animals killed such that the reduction of the number of animals killed to, say, one-half of the original total will mean that the stock has dwindled to one-half. The basis of the calculation is that the rate of reduction of the catches must be proportional to the fraction of the total stock killed each year, i.e. if a large fraction of the whole stock is killed each year there will be a rapid decline in the yearly catches and vice versa. Thus if A is the stock and B the catch in one year, and p the percentage reduction of the catches in subsequent years, then A could be ascertained from the formula

$$A : B = 100 : p.$$

This method was applied by Hjort, Jahn and Ottestad to the diminishing catches in the Iceland whaling from the peak in 1902 to its cessation in 1915. As a check on the results they also tried another mathematical method. They found that the catch per catcher at first increased, reaching its maximum in 1895, and thereafter declined. The estimation of the total stock was based on the assumption that when the yield per catcher is at its maximum there is an equilibrium between the whales caught and the rate of regeneration of the stock. From what is known of the reproductive habits of whales they concluded that the catch at this point would be one-seventh of the stock, and with a suitable allowance for mortality could therefore work out the size of the stock from year to year. The results obtained by this method when applied to the Iceland fishery compared fairly well with the results obtained by Helland's method.

These mathematical methods are described here only in the barest outline, and when put into practice they are of course beset with difficulties. The primary assumptions on which they are based are not more than approximately correct, and various allowances must be made such as for irregularities in the rate of decline of the catches and changes in the catching capacity of the industry arising from technical, economic and political factors and weather conditions. There is the question whether the catches year by year are representative of the same stock, and calculations of the rate of regeneration are based on estimates of growth and rate of propagation, some of which at least require confirmation (see pp. 221–5). Hjort, Jahn and Ottestad fully admitted these difficulties and made it clear that their purpose was to expound possible methods of estimating the magnitude of the stock, pending the accumulation of adequate statistics and fuller knowledge of the relevant biological factors. They considered, however, that such methods could at least be used to estimate the minimum stock which must exist in the Antarctic if current whaling activities were not to result in disastrous depletion.

The position is that there are several methods by which it should in theory be possible to calculate the approximate magnitude of the stock of whales. Individually they are unreliable, since each involves certain doubtful assumptions or is affected by uncertain factors. When our knowledge of the reproduction, growth, age and distribution of whales has become more precise, and when statistics of catches cover an adequate series of years, these calculations should become more reliable; and if then approximately the same estimates are obtained by different means they could be accepted with some confidence. Further, if the estimates of the relative abundance of Blue, Fin and Humpback whales given on p. 266 are accepted, an estimate of the stock of one species would provide also an approximate figure for the other two. We may at least hope to be able to state maximum and minimum figures not too far apart to be of practical value.

THE EFFECT ON THE STOCK OF WHALING AT DIFFERENT TIMES AND IN DIFFERENT PLACES

It is generally agreed that measures are necessary for the conservation of the stocks of whales in the Southern Ocean, but since we are not yet in a position to calculate the number of whales which could be taken and yet replaced by natural regeneration, the measures so far adopted for the regulation of the industry have been framed with the general purpose of checking the rate of depletion rather than of aiming at a strictly rational annual catch. There are several possible methods of doing this. Protection can be given to certain species and classes of whales, the whaling seasons can be limited, geographical restrictions can be imposed (for example, by the institution of sanctuaries) and the catching capacity of the industry can be regulated (e.g. by limiting production or the numbers of factories and catchers). A full discussion on the regulation of whaling, which involves technical and political matters, would be out of place here,[1] but it may be helpful if attention is drawn to the relative effect on the stock of hunting the different kinds of whales at different times of year and in different places.

SPECIES AND CLASSES OF WHALES

It is naturally desirable that regulations should extend protection to those species and classes of whales which are most in need of it, and at the same time, so far as possible, allow for the maximum production per whale killed. For instance, other things being equal, it is better that old whales should be killed than immature ones, since the former will have reproduced themselves, and not the latter; and it is better that large or fat whales should be killed than small or thin ones, because the products obtained will be greater per unit removed from the stock, or, to put in another way, fewer whales will be killed for a given yield. In different regions and at different times of year the catches will be composed of different proportions of species, sexes, sizes, ages, and sexual and physical conditions of whales; and it is because the killing of some of these categories is more harmful to the stock than the killing of others that the effect of whaling will differ in different localities and at different times of year.

(i) Blue, Fin and Humpback whales are the three species with which we are primarily concerned here, and the reasons have been given in previous pages for believing that the Humpback and Blue whales, especially the former, are more in need of protection than the Fin whale. It might be argued that it would make little difference to the total raw materials available whether the catching was mostly of one species or equally of all three except in so far as some species are more productive than others. This is perhaps a debatable point, but apart from any opinions on the desirability of protecting the fauna as an end in itself, it is probable that the catching of an already depleted species will cause a greater reduction of the total stock than the same amount of hunting of a species whose numbers have not been much affected. Thus it is probable that a given number of Fin whales killed could be replaced by natural regeneration of the stock, while the same number of Humpbacks killed (or still more the equivalent number in Blue whale units) would result in a definite reduction of the stock because it can be assumed that the Humpback stock is smaller, besides being segregated into more or less self-contained communities, and therefore has less capacity for regeneration.

(ii) It is reasonable to suppose that males can be more easily spared from the stock than females. The killing of females must be presumed to impair the regenerative capacity of the stock more than the killing of males, for there is no reason to suppose that whales are strictly monogamous.

(iii) The question of size is closely connected with that of age and sexual and physical maturity. The occurrence and distribution of these classes of whales will be better understood when the data on ovaries have been worked out. In the meantime it can be said that it is better to kill a large or old whale than a small or young whale because a better yield is obtained from a large whale, and because a young whale will have contributed little or nothing to the stock in reproducing itself.

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[1] For information on regulations in force before the war reference should be made to the International Agreement for the Regulation of Whaling of 1937 and the Protocol of 1938 (see References, p. 299). The Final Acts of the conferences, published with the texts of the Agreement and Protocol, are especially informative, for they give a concise account of the purpose of the regulations, of other measures which have been considered, and of the difficult problems which are involved in such legislation.

(iv) Adult females may be pregnant, lactating or resting. Existing regulations prohibit the killing of a lactating female (i.e. one nursing a calf) because it is presumed that the calf cannot survive without the mother, and two whales are thus killed for the products of one. The killing of a pregnant female means a loss to the stock of one adult and one potential calf. This cannot justly be regarded as the killing of two whales, for if that were so we could equally regard the killing of a resting female as the loss of two (or more) whales on the ground that it would normally become pregnant next year (and on subsequent occasions). A distinction must therefore be recognized between actual and potential whales. This does not mean, however, that the killing of an immature whale is no more damaging than the killing of, say, a mature resting whale, for it must be supposed that in natural conditions there is a limit to the possible number of calves any female can have. When an immature whale is killed all these potential calves are lost, whereas when an adult female is killed the chances are that she has already reared a certain number of her possible calves, and there are so many fewer to come, according to her age. To be added to this is the far better yield from an adult, so that from both points of view the killing of immature whales is undesirable. It is noteworthy also that a better yield of oil is to be expected from pregnant than from lactating females.

Thus in general it is better to kill Fin rather than Blue or Humpback whales; males rather than females; large and old whales rather than small and young or immature whales; resting rather than pregnant females; and pregnant rather than lactating females.

WHALING IN DIFFERENT REGIONS

It has been shown (p. 236) that the different whaling grounds of the southern hemisphere fall naturally into certain major groups according to their geographical positions and the species of whales taken. In the southern summer we have the whaling on the Antarctic pelagic grounds and at South Georgia, and the practically insignificant former industries of the Falkland Islands and Kerguelen Island. In the winter when the whales have migrated to the north we have the subtropical stations (principally Natal and Cape Province) and the tropical centres such as off the Congo and Western Australia. Details of the species of whales taken at the various whaling centres are given in Table 10 (p. 234). Certain differences between the Antarctic summer whaling and the winter whaling in warmer waters may be seen at a glance from this table and were referred to on p. 236. The tropical stations (Congo, Brazil, Angola, East Africa, West Australia, and Madagascar) take hardly anything but Humpbacks (except at Angola); the subtropical stations (Walvis Bay, Natal, Cape Province and Chile) take Blue, Fin, Humpback, Sei and Sperm whales in various proportions; the Antarctic industry depends mainly on Blue and Fin whales, sometimes also taking substantial numbers of Humpbacks. In

Table 29. *Catches of species and classes of whales compared in winter and summer whaling*, 1937 *and* 1936–7

Whaling centres	Total no. of whales	Percentage of species					Oil per Blue whale equivalent* (barrels)	Sex ratio (% males)			Average length (♂ and ♀, in feet)			Percentage immature		
		Blue	Fin	Sei	Humpback	Sperm		Blue	Fin	Humpback	Blue	Fin	Humpback	Blue	Fin	Humpback
Winter whaling, 1937:																
(*a*) Tropical																
Congo	298	—	—	—	100·0	—	115·6	—	—	55·4	—	—	38·73	—	—	52·7
West Australia	3,246	—	—	—	99·9	0·1	101·5	—	—	63·9	—	—	39·60	—	—	44·8
Madagascar	1,257	0·3	1·8	0·6	97·3	—	105·8	—	(50·0)	61·6	—	(60·27)	39·19	—	(81·8)	44·9
Mean, tropical		*0·1*	*0·6*	*0·2*	*99·1*	*0·03*	*107·6*	—	*(50·0)*	*60·3*	—	*(60·27)*	*39·17*	—	*(81·8)*	*47·5*
(*b*) Subtropical																
Natal	1,629	4·1	46·4	3·9	14·7	30·9	96·3	(58·1)	57·1	51·2	66·23	59·91	36·53	86·6	68·3	71·6
Cape Province	782	7·4	51·3	11·0	3·6	26·7	95·7	(45·6)	54·8	(50·0)	66·74	59·91	(40·04)			
Peru	3,952	1·7	2·5	0·1	0·2	95·5	60·4	(67·2)	(59·8)	—	70·99	57·75	—	68·7	79·4	—
Mean, subtropical		*4·4*	*33·4*	*5·0*	*6·2*	*51·0*	*84·1*	*57·0*	*57·2*	*50·6*	*67·99*	*59·19*	*38·28*	*80·6*	*72·0*	*71·6*
Mean, winter whaling		*2·2*	*17·0*	*2·6*	*52·6*	*25·5*	*95·8*	*57·0*	*53·6*	*55·4*	*67·99*	*59·73*	*38·72*	*80·6*	*76·9*	*59·5*
Summer whaling, 1936–7:																
Antarctic																
South Georgia	1,758	6·9	61·3	26·8	1·0	4·0	104·5	48·8	52·6	47·1	71·79	63·56	39·82	67·8	46·1	(47·1)
Antarctic, pelagic	32,821	43·2	40·5	0·1	13·6	2·6	111·7	51·6	56·1	49·4	77·49	67·80	40·59	33·4	15·1	38·8
Mean, summer whaling		*25·0*	*50·9*	*13·4*	*7·3*	*3·3*	*108·1*	*50·2*	*54·3*	*48·2*	*74·64*	*65·68*	*40·20*	*50·6*	*30·6*	*42·9*

* Sperm whales excluded.

the Antarctic of course much greater numbers of whales have been taken than in the warmer waters, and the catching has on the whole been more continuous.

These are the outstanding differences between the major divisions of the whaling grounds, but for a consideration of the relative effect on the stock of whaling in these different regions a rather more detailed comparison is needed. Although there is almost complete information on the numbers of each species taken at each whaling centre, there is unfortunately very little information on the proportions of different sexes, sizes and other classes of whales in the winter catches at tropical and subtropical stations. Some fuller details have appeared in the more recent numbers of the International Statistics, but only those referring to the 1937 season give the details at a sufficient number of winter stations to provide a useful comparison. Table 29 is based on these statistics and includes particulars of the preceding Antarctic summer season (1936–7). This table is to be read with a good deal of reserve, for some of the figures are misleading. The proportions of the species, although valid for 1937, are not representative of the catches in general, for Table 10 clearly shows that at many localities the proportions of the species in the catches have changed considerably. The yield of oil per Blue whale unit, for reasons given on p. 208, cannot be taken as strictly comparable for different places where the constitution of the catch is different. Other figures, such as the sex ratio, etc., are in some cases based on an inadequate number of whales. Finally, the average lengths and percentage of immature whales are based on whalers' measurements which one cannot expect to be wholly accurate. However, this table is instructive where there are outstanding differences in the figures and where it can be checked with Table 10 and with previous results of the Discovery Committee's observations.

It is seen that the yield of oil is highest in the Antarctic pelagic whaling and lowest at the subtropical stations. The cause of this might be simply that the average size of the whales is less at the latter, but it must be supposed to be due in part to the poorer condition of the whales. Mackintosh and Wheeler (1929, pp. 364–72) showed that at Saldanha Bay, although the large whales which had recently arrived from the Antarctic feeding grounds were in good condition, the small whales, which made up a much greater part of the catch, had thinner blubber than whales of the same size at South Georgia. The comparatively high yield at tropical stations would be explained if most of the Humpbacks are taken there before they have lost condition, or if 2½ Humpbacks are in reality equivalent to rather more than one Blue whale (see p. 208).

The percentage of immature whales is almost everywhere higher and the average length lower in the tropical and subtropical centres than in the Antarctic. This fact has often been commented upon. The percentage of immature Blue and Fin whales at South African stations is especially high, but the percentage of immature Humpbacks at tropical stations is not much more than in the Antarctic. There is a high percentage of immature Humpbacks at subtropical stations, but here the species is taken in insignificant numbers.

For the sex ratio a better standard of comparison is provided in Table 22, p. 268. On p. 267 it was remarked that, although the sexes of each species are approximately equal, male Fin and Blue whales predominate slightly in the Antarctic catches, and male Fin and female Blue at South Georgia and most of the winter whaling centres. Humpbacks show a comparatively large excess of males at tropical stations, and of females in the Antarctic.

It is difficult to make any comparison between the numbers of pregnant, lactating and resting whales in the Antarctic and warmer waters. The Discovery Committee's investigations at Saldanha Bay and at Durban have shown that among the few adults examined a high proportion had recently ovulated and might already have been impregnated. There is no particular reason to suppose that the ratio of adult resting whales differs much as between the winter and summer catches. It may be held though that, apart from other things, rather more harm is inflicted on the stock by interference with the whales in the active breeding season (i.e. in winter) than by catches in summer, although the latter do of course include a proportion of pregnant whales. These remarks must be taken to apply also to Humpbacks. This species, however, is in a different position. Blue and Fin whales taken in coastal waters in winter consist mostly of small immature whales, and the bulk of the stock of breeding adults is missed from the winter catches. Of Humpbacks, however, the breeding adults become concentrated in tropical coastal waters. The consequence is that although the ratio of immatures is not so high as in Blue and Fin whales, the actual numbers of them are probably comparable (for when both tropical and subtropical stations are active the total numbers of Humpbacks killed greatly exceeds the total number of Blue and Fin whales), and, in addition, a large number of breeding adults are killed. Thus in the tropical and subtropical catches taken together, more damage is inflicted on the stock of Humpbacks than on that of Blue and Fin whales.

Table 30 may perhaps help us to judge the comparative effect on the stock of whaling in tropical, subtropical and Antarctic waters. It lists those features which are relatively advantageous or disadvantageous to the stock. The heading 'Favourable' is not of course used in an absolute sense, for naturally it is not actually beneficial to the stock that, for instance, large numbers of Fin whales are killed in the Antarctic. It would be very difficult accurately to assess the relative importance of the various points enumerated here, but those which are obviously of greater weight than others are printed in italics. For the rest it is intended rather as a list of some of the points which would need consideration if any regulations were contemplated which would discriminate between the different regions. It can at least be said, however, that apart from the actual numbers of whales killed, the tropical and subtropical whaling is, on balance, far more damaging to the stock than the Antarctic whaling.

Whaling at the tropical stations is probably more harmful than at the subtropical stations. Most of the whales caught at the latter are immature and in poor condition, which signifies highly uneconomic whaling; but since no particular species is caught in very large numbers the absolute effect on the stock cannot be very great. At the tropical centres, on the other hand, although a reasonable yield of oil per Blue-whale equivalent is obtained, the whole industry is directed against the one species which most needs protection. Naturally no suggestion is made here that there is a case for regulations discriminating against these localities, for other matters besides the prospects of the stock have to be considered, and Humpbacks have already received some protection in the Antarctic and of course through the reduction of whaling during the war.

Table 30. *Features of the catches in tropical, subtropical and Antarctic regions regarded as relatively favourable or unfavourable to the stock*

<table>
<tr><th>Favourable</th><th>Unfavourable</th></tr>
<tr><td colspan="2">Tropical centres</td></tr>
<tr><td>1. <i>Whaling is on a small scale compared to the Antarctic.</i>
2. There is a higher percentage of males than in the Antarctic catches.
3. There is a lower percentage of immature Humpbacks than in subtropical catches.</td><td>1. <i>The catches consist almost entirely of Humpbacks.</i>
2. There is a higher percentage of immature whales than in the Antarctic catches.
3. There is interference with the active breeding season.
4. There is probably a slightly lower yield of oil than from Humpbacks in the Antarctic.</td></tr>
<tr><td colspan="2">Subtropical centres</td></tr>
<tr><td>1. <i>Whaling is on a small scale compared to the Antarctic.</i>
2. Few Blue and Humpback whales are killed, and the catch is diluted with Sperm whales (the stock of which is not so far known to have suffered much from whaling).</td><td>1. <i>There is a very high percentage (60–80%) of immature whales.</i>
2. Such mature whales as are killed are in the active breeding season.
3. There is a relatively low yield of oil per Blue whale equivalent.</td></tr>
<tr><td colspan="2">Antarctic centres</td></tr>
<tr><td>1. The Fin whale is now the species most commonly taken.
2. The percentage of immature whales is relatively low.
3. Whales are not hunted in the active breeding season.
4. The yield of oil is relatively high.</td><td>1. <i>The total number of whales killed is very great.</i>
2. Blue whales are still killed in considerable numbers.
3. When Humpbacks are taken they include an excess of females.</td></tr>
</table>

Turning now to whaling in different parts of the Antarctic, it is well known that Blue whales tend to go into colder water than Fin whales, and factories working in the southern part of the zone populated by whales in summer would expect to catch a rather higher proportion of Blue whales than if they worked farther north away from the edge of the pack-ice. This might not apply so much to the later part of the summer, for there is some evidence that Fin whales are then inclined to penetrate into colder water, possibly because their blubber has become thicker after some time on the southern feeding grounds.

It is difficult to judge the relative effect on the stock of taking whales in the different Antarctic areas, for there is much less difference between the catches in these areas than between the catches in the Antarctic as a whole and those in subtropical and tropical waters. Some comparison has already been made of the species ratio in areas I–VI (see pp. 264–6) and the percentage of immature whales (p. 280). It is clear that in area II the catches are mostly of Fin whales. Few Blue and hardly any Humpbacks are to be found. This is not necessarily because there are more Fin whales in this than in other areas. It is more likely that Blue and Humpback whales have been depleted in area II. In area III a considerably higher proportion of Blue whales is taken, and there is evidently a substantial stock of Humpbacks still in this area. In area IV again Humpbacks are plentiful, and probably more so than in area III. The Blue/Fin ratio is uncertain, but there would appear to be considerably more Blue whales than in area II. Less is known of the other areas, but it is probable that in areas I and VI the catches would depend mainly on Fin whales with some Humpbacks in area I.

WHALING IN DIFFERENT MONTHS

A point of some importance is the relative effect of whaling early and late in the summer season in the Antarctic. In recent years the Antarctic season has been restricted to three months, and a question sometimes arises as to the desirability of advancing or retarding the opening and closing dates. Tables 23 and 27 (pp. 270 and 277) show that in the early months the catches on the pelagic grounds include a high proportion of Blue whales and pregnant females. For reasons given above this species and class of whale are more in need of protection than most others. Furthermore, the whales are in poorer condition at the beginning of the season, and the products obtained per whale killed are therefore less. In the later part of the season there is a substantial increase in the proportion of Fin whales, a reduction in the proportion of pregnant whales and an improvement in condition (see pp. 270, 277 and 250). (An early or late season would not seem to make much difference to the catches of Humpbacks.) In the later part of the season, on the other hand, there are slightly more immature whales and probably more lactating females, but both these classes have received some protection, the former through the establishment of minimum lengths in 1937 and the latter through the prohibition in 1934 of the killing of mothers accompanied by calves. In view of these facts it is to be expected that on the Antarctic pelagic whaling grounds less harm is done to the stock by the killing of a given number of whales in the late summer than in the early summer. This conclusion, however, does not apply to the local industry at South Georgia. Here the Fin-whale maximum sometimes precedes the Blue-whale maximum, so that whaling in the early months does not necessarily bear heavily on the Blue-whale stock. There are again more pregnant whales in the early months and the condition of the whales improves in the later months, but the older whales (which are more easily spared) predominate in the early months (see p. 274), and there is a decline in the average lengths towards the end of the season, and a more pronounced increase in immature whales than we find in the pelagic catches. Although the prescribed minimum lengths are designed to protect immature whales, they are below the mean length at which maturity is reached, and the protection is by no means complete. In the circumstances there is some doubt whether the stock is more affected by whaling in the early or late months at South Georgia.

A NOTE ON SANCTUARIES

Although it is hard to say whether the stocks of whales are more in need of protection in one part of the Antarctic than in another, some attention should be given to the question of sanctuaries, for this is one of the more important (though not necessarily the best) of the possible methods of checking depletion. At the International Whaling Conference of 1938 it was agreed to prohibit, in the first place for a period of two years, the taking of whalebone whales in the Antarctic between the meridians of 70 and 160° W; that is to say, the greater part of areas I and VI (Fig. 8, p. 257) were closed as a sanctuary. No whaling has been carried on in this part of the Antarctic, and the institution of a sanctuary there was intended to safeguard a reserve of whales against further expansion of the whaling grounds, rather than to curtail the activities of the whaling industry. In view of the tendency of the stocks of whales to segregate in the six Antarctic areas it would seem natural that the boundaries of a sanctuary should coincide with the boundaries of one or more of the areas, for the sanctuary could then be delimited with the expectation of some definite effect on the stock or the whaling industry, and the results could be much better understood than if arbitrary limits were fixed.

The results of whale marking also have an obvious bearing on the question of sanctuaries. Of the marks recovered in the Antarctic all those returned from Humpbacks and a high proportion of those from Blue and Fin whales were recovered in the same area as that in which they were fired. This implies, as was noted on p. 251, that there is no indiscriminate shuffling of the stocks, and that a reduction in one or more areas should not, for some time, cause a reduction in other areas. It is to be supposed then that if an area were closed to whaling the stocks of whales in that area would maintain their numbers for a considerable time even if heavy depletion were going on in adjacent areas. The local stock of Humpbacks might remain permanently unaffected if the sanctuary enclosed one of the self-contained groups of that species provided that they were not being hunted at the northern end of their migration route; but since there is a slow infiltration of Blue and Fin whales from one area to another, the sanctuary might slowly be drained of those species, or indeed if the stocks of whales in adjacent areas were not being reduced too fast the sanctuary might act as a reserve from which the adjacent areas were gradually fed with Blue and Fin (but not Humpback) whales. On the other hand, it is possible that whales learn to avoid the areas of intensive whaling, and might actually move into the sanctuary. Such effects can hardly be predicted, but there seems good reason to believe that reserves of whales can be protected by means of sanctuaries, or the killing of whales might be stopped in certain areas where there were signs of excessive local depletion. The principle might of course be applied only to one species, but it may be suggested that the term 'sanctuary' is best applied to an area in which hunting is totally prohibited.

THE REDUCTION OF WHALING DURING THE WAR

Discussions in this paper on the condition of the stock of whales arise from circumstances which existed before the outbreak of war. Since then whaling has been much reduced, and the effect of the industry on the stock is a matter of little application at the present time. However, it is to be supposed that questions relating to the stock will assume importance after the war, and it has seemed desirable that the relevant data should in the meanwhile be examined as fully as possible.

The reduced activity of the fishing industry in European waters during 1914–18 resulted in a notable recovery in the stocks of fish. Since the reproductive capacity of whales cannot be compared with that of fish, it does not of course follow that the present respite will have a parallel effect, though it must be beneficial. If whaling is resumed on any large scale it would be of much importance to obtain without delay any data which would allow a comparison of the condition of the stock before and after the war. Average lengths and the percentage of immature whales in the catches should be instructive in this connexion, but possibly more valuable would be observations on ovaries, for any recovery in the stock should be reflected in an increase in the average number of corpora lutea in samples properly comparable with pre-war data. A measurement of the result on the stock of the reduction or cessation of whaling for a number of years would not only be of value per se but might also throw new light on the actual rate of regeneration of the stock.

SUMMARY

The preceding paper is based on the more direct observations on whales carried out by the Discovery Committee, and the results are correlated with statistics of the whaling industry. The work is incomplete in so far as a large body of data on the ovaries of whales has not yet been fully analysed.

1. No evidence is found to suggest that the well-known species of whalebone whales in the Southern Ocean can be divided into any subspecies or races such as might imply separate stocks of whales, but there appear to be distinct colour varieties of Humpbacks. The small Blue whale known as *Myrbjonn* and the small dark Fin whale distinguished by the whalers are sexually immature, but may also represent colour varieties of those species.

2. Mean lengths at birth are estimated to be approximately as follows:

Blue	7·0 m. (23·0 ft.)
Fin	6·5 m. (21·3 ft.)
Humpback	4·5–5·0 m. (14·8–16·4 ft.)
Sei	4·5 m. (14·8 ft.)
Southern Right	6·0 m. (19·7 ft.)

A larger number of records of the largest foetuses and the smallest calves may yet call for some adjustment of these figures, but it is believed that they are not far from correct.

3. The largest whales (all females) measured by the Discovery Committee's staff were:

Blue	28·50 m. (93 ft. 6 in.),
Fin	24·50 m. (80 ft. 5 in.),
Sei	17·10 m. (56 ft. 1 in.),
Humpback	14·90 m. (48 ft. 11 in.),

but these lengths must sometimes be exceeded.

4. An account is given of the few known records of the weights of whales. The greatest is that of a Blue whale of 27·18 m. (89 ft. 2 in.) which weighed about 120 tons.

5. The average yield of oil obtained by modern whaling methods appears to be about 100 barrels from a Blue whale, 50 from a Fin, 40 from a Humpback and 17 from a Sei.

6. Blue, Fin and Humpback whales in the Antarctic feed heavily and almost exclusively on *Euphausia superba* (the 'krill'). Occasional fish and squids form an insignificant part of their diet. All the evidence indicates that in temperate and tropical waters in winter they find very little to eat.

7. A list is given of the common species of external parasites and the species of whalebone whales on which they occur. *Pennella* shows that a whale's blubber has a faculty of ejecting foreign bodies such as whale marks, and it is noted that various parasites provide some evidence of the migrations of whales. A reference is made to the literature on internal parasites. Little is known of diseases in whales. Various growths, tumours and abcesses are found from time to time in different parts of the body, and a few other pathological symptoms and some injuries and abnormalities have been reported.

8. In the light of additional data some small corrections are made to the original estimates of the mean length at sexual maturity in Blue and Fin whales.

9. A summary is given of previous investigations on breeding, growth and age. It cannot be doubted that the old corpora lutea of the ovaries last for many years, and there is good reason to believe that they persist as recognizable and countable bodies throughout the life of the whale. It is certain that ovulation is spontaneous and highly probable that whales are polyoestrous. The interval between pregnancies is variable. It is believed that two years is the normal period, but females may occasionally become pregnant again while still nursing a calf, and in many instances the interval no doubt extends to three years.

10. Growth from birth to sexual maturity was originally estimated to take place in Blue and Fin whales in two years. It is not certain that this estimate was correct, but the recovery of a mark showed that a Fin whale almost certainly grew from birth to sexual maturity in not more than three years, and may well have done so in two. It is possible that this period also is variable.

11. Methods of age determination are reviewed, but the subject is dealt with only briefly pending full analysis of the data on ovaries. A recently recovered mark showed that the rate of accumulation of the old corpora lutea in one Fin whale cannot have been more than eight in six years, and may have been less.

12. The statistics of catches provide much information on the stocks of whales, but

allowance must be made for the fact that catches are not fully representative samples of the stock, and complete accuracy in the statistics cannot be expected.

13. The whaling grounds of the southern hemisphere fall naturally into three principal groups: tropical coastal waters in which Humpbacks are taken, subtropical or temperate coastal waters with mixed catches, and the Antarctic where the industry depends mainly on Blue and Fin whales.

14. Humpbacks in the southern hemisphere are divided into several separate communities or stocks between which there can be very little exchange. They are known to frequent both the east and west coasts of each of the three southern continents in winter. The positions of catches and the marking records of the 'William Scoresby' show that in summer in the Antarctic they are segregated into clearly separate groups which, from their position alone, might be expected to correspond with the separate tropical coastal resorts in winter. Recoveries of whale marks clearly prove that an Antarctic group lying south-west of Australia contains the same whales as appear off the West Australian coast in winter, and a connexion has been established between a group south of South Africa and the Humpbacks caught in winter off Madagascar. It is inferred that each of the Antarctic summer groups has its own migration route to the coastal waters of a continent lying in most cases approximately to the north of it. There appear to be five such groups, but it is not certain that they are all rigidly separated from one another. Hjort, Lie and Ruud divided the pelagic whaling grounds into four main areas on the basis of the grouping of the whaling fleet. Each of these areas contains one of the Humpback groups.

15. The migrations and distribution of Blue and Fin whales are less clearly defined than those of Humpbacks. Only one instance of migration between the Antarctic and warmer waters has been demonstrated by whale marking, but there is abundant circumstantial evidence that such migrations take place. Little is known of their destination when they move northwards in winter, but it is supposed that most of them become dispersed in temperate waters. In the Antarctic Blue and Fin whales are more evenly distributed than Humpbacks, but again the positions of capture and marking show that they have at least a tendency (more definite in Blue than in Fin whales) to concentrate in the same areas as Humpbacks. Whale marking has shown, furthermore, that they generally return to the same part of the Antarctic after the northward migration, but unlike the Humpbacks these species sometimes move from one area to another.

16. Records of whales observed during voyages of the 'Discovery II' seem to confirm the Antarctic grouping of whales and suggest that the whole Antarctic zone might be divided into six areas, each containing a community of whales.

17. Observations by the 'Discovery II', and the marking of whales by the 'William Scoresby', suggest that in the Southern Ocean the existing ratio of Blue, Fin and Humpback whales is of the order of 15, 75 and 10 % respectively. This estimate is not very reliable, but it seems certain that Fin whales heavily outnumber the other two species. The species ratio varies in the different Antarctic areas.

18. The foetal records and the total catches in all localities indicate that in Blue, Fin,

Sei, and Humpback whales slightly more males are born and survive than females. There are some persistent local variations, notably in Humpbacks, which show a considerable excess of females in the Antarctic and males in the tropical catches.

19. In the course of the summer season in the Antarctic some important changes take place in the composition of the whale population. On the pelagic whaling grounds there is always a marked fall in the proportion of Blue, and a corresponding rise in the proportion of Fin whales as the season goes on; but at South Georgia the maximum catches of Blue whales sometimes precede and sometimes follow the maximum catches of Fin whales. The sex ratio fluctuates a little but does not appear to undergo any important change. There is a higher proportion of young and immature whales in the late summer than in the early summer. This change is not very marked on the pelagic grounds, but is more noticeable at South Georgia. As the summer advances there is a marked decline in the percentage of adult females pregnant.

20. Changes in the ratio of species in the catches, in the average length, and in the percentage immature all indicate a significant depletion of the stock of Blue whales. There seem to be no obvious signs as yet of any serious depletion of the Fin-whale stock, but statistics of catches show that Humpbacks have been severely depleted at least in certain regions. Whale marking indicates that the fraction of the stock of each species removed by hunting is greater in Blue than in Fin whales, and greater in Humpback than in Blue whales.

21. Several possible methods of calculating the absolute magnitude of the stock are discussed, and it is thought that when more precise information on the habits and distribution of whales is available some useful approximation might be reached.

22. Reasons are given for supposing that less damage is done to the stock by the killing of Fin than Blue whales, males than females, large and old than small and immature whales, resting than pregnant females, and pregnant than lactating females. This leads to the conclusion that although the stock must be more affected by the Antarctic industry, owing to the large numbers of whales killed, whaling in the winter season in temperate and tropical coastal waters must be more damaging in proportion to the products obtained; and the tropical Humpback fishery is probably more harmful than the mixed catches at such centres as Durban and Saldanha Bay.

23. From the point of view of the stock whaling on the Antarctic pelagic grounds is probably more economical in the late than in the early summer months, but at South Georgia it is difficult to say whether there is much difference.

24. The institution of sanctuaries as a means of checking the depletion of the stock is discussed, and it is suggested that reserves of whales could be maintained if a considerable area in the Antarctic is closed to whaling.

25. It is hoped that in due course the effect on the stock of the reduction of whaling in war time can in some way be measured.

APPENDIX

COMMON NAMES OF WHALEBONE WHALES

The following list may be convenient for reference. Most of the common synonyms appear in a list of definitions in the International Whaling Agreement of 1937 for which they were supplied by Dr F. C. Fraser.

BALAENIDAE (Right whales)

Balaena mysticetus. Greenland Right whale. Also known as Arctic whale, Bowhead and Great Polar whale. Distribution: Arctic regions only.

Balaena glacialis. North Atlantic Right whale. Also known as Biscayan Right whale, Nordcaper, North Cape whale, Black whale and Scrag whale. Distribution: Northern hemisphere.

Balaena australis. Southern Right whale. Distribution: Southern hemisphere.

Neobalaena marginata. Pigmy Right whale. Distribution: Known only in the southern hemisphere.

BALAENOPTERIDAE (Rorquals)

Balaenoptera musculus. Blue whale. Also known as Sibbald's Rorqual, Sulphurbottom and Great Northern Rorqual. Distribution: World wide.

Balaenoptera physalus. Fin whale. Also known as Finback, Finner, Common Rorqual, Herring whale and Razorback. Distribution: World wide.

Balaenoptera borealis. Sei whale. Also known as Rudolphi's Rorqual, Pollack whale and Coal-Fish whale. Distribution: World wide.

Balaenoptera brydei. Bryde's whale. Distribution: Recorded only in catches at South African whaling stations, and once from the West Indies.

Balaenoptera acutorostrata. Minke whale. Also known as Little Piked whale, Pike-Headed whale and Lesser Rorqual. Distribution: Northern and southern hemispheres.

Megaptera nodosa. Humpback whale. Also known as Humpbacked whale, Hunchbacked whale, Hump whale and Bunch. Distribution: World wide.

RACHIANECTIDAE

Rachianectes glaucus. Grey whale. Also known as Californian Grey whale, Pacific Grey whale, Devil Fish, Hard Head, Mussel Digger, Grey Back and Rip Sack. Distribution: North Pacific Ocean.

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[*Discovery Reports. Vol. XXII, pp.* 301–510, *Plates V–XIII, September* 1943]

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POLYZOA (BRYOZOA)

I. SCRUPOCELLARIIDAE, EPISTOMIIDAE, FARCIMINARIIDAE, BICELLARIELLIDAE, AETEIDAE, SCRUPARIIDAE

By

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British Museum (Natural History)

CONTENTS

Introduction . . . . *page* 303

  Interpretation of Busk's work 303

  Acknowledgements 304

List of stations, and of the species collected at each 305

List of species discussed 318

Systematic descriptions 319

Geographical distribution of species 477

The relation between hydrological conditions and the distribution of the species 491

Geographical distribution of genera 492

Seasonal distribution of ancestrulae 497

Note on the vermiform bodies found in some Polyzoa 499

Addendum 501

References 501

Index 506

Plates V–XIII . . . . *following page* 510

POLYZOA (BRYOZOA)

I. SCRUPOCELLARIIDAE, EPISTOMIIDAE, FARCIMINARIIDAE, BICELLARIELLIDAE, AETEIDAE, SCRUPARIIDAE

By Anna B. Hastings, M.A., Ph.D.
British Museum (Natural History)

(Plates V–XIII; Text-figs. 1–66)

INTRODUCTION

In the course of the Discovery Investigations an exceptionally fine collection of Antarctic and sub-Antarctic Polyzoa has been made, as well as small collections from South Africa, New Zealand and certain islands in the tropical Atlantic. Together with this Discovery material I have studied the collections made by the National Antarctic Expedition (1901–4) and the British Antarctic ('Terra Nova') Expedition;[1] the South Georgian Polyzoa collected by the Shackleton-Rowett ('Quest') Expedition; and collections from the Falkland Islands lent to me by the Hamburg Museum and the U.S. National Museum.

British Museum specimens are designated throughout by their registration numbers which consist of four numbers separated by full stops, thus: 87.12.9.166, or 1938.3.5.1.

Six families are considered in this report. They comprise eighty Antarctic and sub-Antarctic species with fifteen varieties (see Table 3, p. 479). The only species in Table 3 that I have not had an opportunity of examining are six of the abyssal forms. A list of the species collected by the Discovery and the Terra Nova Expeditions at localities outside the Antarctic and sub-Antarctic area is given on p. 491. A list of the species discussed in the systematic part of the report is given on p. 318, and on p. 305 a list of species obtained at each Discovery station.

The inclusion of the Scrupariidae is for convenience, and is not meant to imply that I regard the problem of whether they belong to the Cellularina or the Malacostega as settled (cf. Harmer, 1926, p. 187). I have no doubt that *Brettia triplex* belongs to the Cellularina, but its relationship to the other species of *Brettia* is uncertain.

INTERPRETATION OF BUSK'S WORK

It should perhaps be explained that Busk's original drawings have recently come into my hands, and, as many of them have unpublished data written on them, they are useful in interpreting his work.

In the past the scanty explanations published with Busk's figures have been a great difficulty. A species would be recorded from several more or less remote localities, and figured without any statement of the origin of the figured specimen. The British Museum Catalogue (1852 and 1854) has given especial difficulty in this way. There is in the Museum a series of slides, received in 1854 and known as the "British Museum Catalogue Collection", but only a small part of the specimens mentioned in the catalogue is represented in this collection, and the rest have been regarded as missing or unrecognizable. The drawings show that the catalogue was, as its name implies, chiefly based on specimens already in the Museum, including the Johnston collection (catalogued by Gray, 1848), whose registered numbers are given on many of the drawings. The slides received in 1854 are specimens from Busk's own collection which he included in the catalogue and deposited in the Museum on its publication.

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[1] Anyone re-examining the Terra Nova material should be warned that some specimens have a false appearance of pigmentation because they have spent many years in jars of mixed material which included animals whose pigment has dissolved in the spirit and stained the whole contents of the jars.

As to the *Challenger Reports*, the series of mounted and unmounted specimens received by the British Museum in 1887 and known as the "Challenger Collection" is almost complete in so far as specimens of each species from nearly every station at which it was recorded are present, but a large number of preparations from this material were kept by Busk and did not come to the Museum till his whole collection came in 1899. It has generally been assumed that the type and figured specimens were to be found among those deposited in 1887, but it is now known that there are some figured and otherwise important Challenger specimens in the 1899 collection.

The work of tracing the figured specimens and preparing a new set of more detailed explanations of Busk's figures is in progress. In the meantime some of the information has been used to solve the problems of the present report.

ACKNOWLEDGEMENTS

I am very grateful to Dr. Thiel and Professor Bassler for the loans of unnamed material from the Hamburg and U.S. National Museums respectively, and for the exchange arrangements by which we have kept some of the material; to Dr Thiel for lending me some of Calvet's type specimens; to the Manchester Museum for frequent loans of type and other specimens from the Waters Collection; to Mr A. A. Livingstone, Professor Ernst Marcus, Professor C. H. O'Donoghue and Professor R. C. Osburn, who have all lent specimens of their own, and to Dr Sixten Bock for lending specimens from the Riksmuseum, Stockholm; to the Discovery Staff, most of whom have at one time or another given me the benefit of their special knowledge of the problems before me, particularly over questions of distribution and hydrology; to the Director of the Scott Polar Research Institute, Cambridge, for the facilities afforded me for consulting various documents, including notes made by Mr Hodgson, naturalist to the National Antarctic Expedition; to Mr W. A. Smith, from whom I have constantly received very reliable help, particularly in listing and sorting collections and checking manuscript and proofs; to Mr M. G. Sawyers for his careful and skilful photography; to Miss E. C. Humphreys for the clearness and accuracy of the maps; to Sir Sidney Harmer for opportunities of consulting his catalogue and for his interest and help throughout my work; and to Dr N. A. Mackintosh for his patience over my unavoidable delays with the proofs.

LIST OF STATIONS, AND OF THE SPECIES COLLECTED AT EACH

DISCOVERY INVESTIGATIONS

Further particulars of the stations are given in the Discovery Investigations Station Lists:

1925–1927. Discovery Reports, I, 1929, pp. 1–140, pls. i–vi.
1927–1929. Discovery Reports, III, 1930, pp. 1–132, pls. i–x.
1929–1931. Discovery Reports, IV, 1932, pp. 1–232, pls. i–v.
1931–1933. Discovery Reports, XXI, 1941, pp. 1–226, pls. i–iv.

R.R.S. 'Discovery'

St. 1. 16. xi. 25. Clarence Bay, Ascension Island, 7° 55′ 15″ S, 14° 25′ W. 16–27 m.
Scrupocellaria frondis Kirkpatrick
Aetea curta Jullien

St. 4. 30. i. 26. Tristan da Cunha, 36° 55′ S, 12° 12′ W. 40–46 m.
Scrupocellaria ornithorhyncus Thomson
Caberea rostrata Busk
Aetea anguina (Linnaeus)

St. 5. 31. i. 26. Quest Bay, Tristan da Cunha. 7–12 m.
Scrupocellaria ornithorhyncus Thomson
Caberea rostrata Busk

St. 6. 1. ii. 26. Tristan da Cunha, 3 miles N 30° E of Settlement. 80–140 m.
Caberea darwinii Busk
Cornucopina pectogemma (Goldstein)

St. 20. 4. iii. 26. South Georgia, 14·6 miles N 41° E of Cape Saunders. 200 m.
Himantozoum antarcticum (Calvet)

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 3·3 miles S 44° E of Jason Light. 110 m.
Amastigia gaussi (Kluge)
Notoplites drygalskii (Kluge)
Farciminellum antarcticum sp.n.
Himantozoum antarcticum (Calvet)
Camptoplites tricornis Waters
C. retiformis (Kluge)

St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, from 8 cables S 81° W of Merton Rock to 1·3 miles N 7° E of Macmahon Rock. 179–235 m.
Amastigia gaussi (Kluge)
Notoplites antarcticus (Waters)
N. tenuis (Kluge)
Camptoplites bicornis var. *magna* (Kluge)
C. retiformis (Kluge)

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, from 6·3 miles N 89° E of Jason Light to 4 miles N 39° E of Jason Light. 120–204 m.
Amastigia gaussi (Kluge)
Notoplites antarcticus (Waters)
N. drygalskii (Kluge)
N. crassiscutus sp.n.
Caberea darwinii Busk
Farciminellum antarcticum sp.n.
Cornucopina pectogemma (Goldstein)
Beania erecta var. *livingstonei* var.n.
Himantozoum antarcticum (Calvet)
Camptoplites tricornis (Waters)
C. retiformis (Kluge)

St. 45. 6. iv. 26. South Georgia, 2·7 miles S 85° E of Jason Light. 238–270 m.
Caberea darwinii Busk
Himantozoum antarcticum (Calvet)
Camptoplites latus var. *aspera* var.n.

St. 48. 3. v. 26. Port William, Falkland Islands, 8·3 miles N 53° E of William Point Beacon. 105–115 m.
Beania costata (Busk)

St. 51. 4. v. 26. Off Eddystone Rock, East Falkland Island, from 7 miles N 50° E to 7·6 miles N 63° E of Eddystone Rock. 105–115 m.

Notoplites elongatus var. *calveti* var.n.
Tricellaria aculeata (d'Orbigny)
Caberea darwinii Busk

St. 53. 12. v. 26. Port Stanley, East Falkland Island, hulk of 'Great Britain'. 0–2 m.

Tricellaria aculeata (d'Orbigny)

St. 56. 16. v. 26. Sparrow Cove, Port William, East Falkland Island, 1½ cables N 50° E of Sparrow Point. 10½–16 m.

Caberea darwinii Busk
Beania costata (Busk)

St. 58. 19. v. 26. Port Stanley, East Falkland Island. 1–2 m.

Beania magellanica Busk

St. 91. 8. ix. 26. False Bay, South West Africa, 0·5 mile off Roman Rock. 35 m.

Bugula calathus Norman

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, from 4·1 miles N 54° E of Larsen Point to 1·2 miles S 62° W of Merton Rock. 230–250 m.

Notoplites drygalskii (Kluge)

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, from 54° 02′ S, 36° 38′ W to 54° 11′ 30″ S, 36° 29′ W. 122–136 m.

Amastigia gaussi (Kluge)
Notoplites drygalskii (Kluge)
Caberea darwinii Busk
Farciminellum antarcticum sp.n.
Beania erecta var. *livingstonei* var.n.
Camptoplites latus var. *aspera* var.n.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, from 54° 04′ S, 36° 27′ W to 53° 58′ S, 36° 26′ W. 155–178 m.

Notoplites drygalskii (Kluge)
Farciminellum antarcticum sp.n.
Himantozoum antarcticum (Calvet)

St. 145. 7. i. 27. Stromness Harbour, South Georgia, between Grass Island and Tonsberg Point. 26–35 m.

Menipea patagonica Busk

St. 148. 9. i. 27. Off Cape Saunders, South Georgia, from 54° 03′ S, 36° 39′ W, to 54° 05′ S, 36° 36′ 30″ W. 132–148 m.

Notoplites antarcticus (Waters)
N. drygalskii (Kluge)
Caberea darwinii Busk
Cornucopina polymorpha (Kluge)

St. 149. 10. i. 27. Mouth of East Cumberland Bay, South Georgia, from 1·15 miles N 76½° W to 2·62 miles S 11° W of Merton Rock. 200–234 m.

Amastigia gaussi (Kluge)
Camptoplites latus var. *aspera* var.n.

St. 152. 17. i. 27. Off South Georgia, 53° 51′ 30″ S, 36° 18′ 30″ W. 245 m.

Notoplites drygalskii (Kluge)

St. 153. 17. i. 27. Off South Georgia, 54° 08′ 30″ S, 36° 27′ 30″ W. 106 m.

Amastigia gaussi (Kluge)
Caberea darwinii Busk

St. 156. 20. i. 27. Off South Georgia, 53° 51′ S, 36° 21′ 30″ W. 200–236 m.

Camptoplites tricornis (Waters)
C. retiformis (Kluge)
Camptoplites asymmetricus sp.n.

St. 158. 21. i. 27. Off South Georgia, 53° 48′ 30″ S, 35° 57′ W. 401–411 m.

Notoplites antarcticus (Waters)

St. 159. 21. i. 27. Off South Georgia, 53° 52′ 30″ S, 36° 08′ W. 160 m.

Amastigia gaussi (Kluge)
Beania erecta var. *livingstonei* var.n.

St. 160. 7. ii. 27. Near Shag Rocks, 53° 43′ 40″ S, 40° 57′ W. 177 m.
Notoplites antarcticus (Waters)
N. crassiscutus sp.n.
Caberea darwinii Busk
Cornucopina ovalis sp.n.
Beania erecta Waters
Camptoplites bicornis var. *quadriavicularis* var.n.
C. tricornis (Waters)

St. 164. 18. ii. 27. East end of Normanna Strait, South Orkneys, near Cape Hansen, Coronation Island. 24–36 m.
Himantozoum antarcticum (Calvet)
Camptoplites bicornis var. *magna* (Kluge)

St. 167. 20. ii. 27. Off Signy Island, South Orkneys, 60° 50′ 30″ S, 46° 15′ W. 244–344 m.
Amastigia gaussi (Kluge)
Caberea darwinii Busk
Camptoplites angustus (Kluge)

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ 30″ S, 53° 46′ W. 342 m.
Beania erecta var. *livingstonei* var.n.

St. 172. 26. ii. 27. Off Deception Island, South Shetlands, 62° 59′ S, 60° 28′ W. 525 m.
Farciminellum antarcticum sp.n.

St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 63° 17′ 20″ S, 59° 48′ 15″ W. 200 m.
Notoplites drygalskii (Kluge)
Farciminellum antarcticum sp.n.
Cornucopina pectogemma (Goldstein)
C. polymorpha (Kluge)
Beania erecta var. *livingstonei* var.n.
Himantozoum antarcticum (Calvet)
Camptoplites areolatus (Kluge)

St. 177. 5. iii. 27. 27 miles SW of Deception Island, South Shetlands, 63° 17′ 30″ S, 61° 17′ W. 1080 m.
Notoplites drygalskii (Kluge)
Beania erecta var. *livingstonei* var.n.

St. 180. 11. iii. 27. 1·7 miles W of north point of Gand Island, Schollaert Channel, Palmer Archipelago. 160 m.
Amastigia gaussi (Kluge)
Camptoplites bicornis var. *magna* (Kluge)
Camptoplites bicornis var. *elatior* (Kluge)

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 64° 20′ S, 63° 01′ W. 160–335 m.
Notoplites antarcticus (Waters)
N. drygalskii (Kluge)
Cornucopina polymorpha (Kluge)
Camptoplites retiformis (Kluge)
C. angustus (Kluge), young colonies only

St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 64° 48′ 30″ S, 63° 31′ 30″ W. 259–354 m.
Notoplites antarcticus (Waters)
N. drygalskii (Kluge)
Camptoplites bicornis var. *compacta* (Kluge)
Camptoplites bicornis var. *magna* (Kluge)
C. retiformis (Kluge)

St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 64° 56′ S, 65° 35′ W. 315 m.
Amastigia gaussi (Kluge)
Cornucopina polymorpha (Kluge)
Himantozoum antarcticum (Calvet)
Camptoplites bicornis var. *elatior* (Kluge)

At same station in 93–126 m.
Amastigia gaussi (Kluge)
Notoplites vanhöffeni (Kluge)
N. tenuis (Kluge)
Caberea darwinii Busk
Cornucopina polymorpha (Kluge)
Beania erecta var. *livingstonei* var.n.
Camptoplites retiformis (Kluge)
C. latus var. *striata* var.n.

St. 195. 30. iii. 27. Admiralty Bay, King George Island, South Shetlands, 62° 07′ S, 58° 28′ 30″ W. 391 m.
Caberea darwinii Busk
Camptoplites retiformis var. *tenuispina* var.n.

St. 222. 23. iv. 27. St Martin's Cove, Hermite Island, Cape Horn. 30–35 m.
Menipea patagonica Busk
Scruparia ambigua (d'Orbigny)

St. 299. 4. ix. 27. Tarafal, San Antonio, Cape Verde Islands. 7–11 m.
Bugula dentata (Lamouroux)

St. 363. 26. ii. 30. 2·5 miles S 80° E of south-east point of Zavodovski Island, South Sandwich Islands. 329–278 m.
Notoplites drygalskii (Kluge)
Cornucopina pectogemma (Goldstein)
Himantozoum antarcticum (Calvet)
Camptoplites retiformis var. *tenuispina* var.n.

St. 366. 6. iii. 30. 4 cables S of Cook Island, South Sandwich Islands. 77–152 m.
Notoplites drygalskii (Kluge)
N. tenuis (Kluge)
Farciminellum antarcticum sp.n.
Cornucopina polymorpha (Kluge)

St. 371. 14. iii. 30. 1 mile E of Montagu Island, South Sandwich Islands. 99–161 m.
Notoplites drygalskii (Kluge)
N. tenuis (Kluge)
Caberea darwinii Busk
Beania erecta (Waters)
Camptoplites retiformis var. *tenuispina* var.n.

St. 388. 16. iv. 30. Off Cape Horn, 56° 19½′ S, 67° 09¾′ W. 121 m.
Amastigia benemunita (Busk)

St. 399. 18. v. 30. 1 mile SE of south-west point of Gough Island. 141–102 m.
Amastigia benemunita (Busk)
Scrupocellaria ornithorhyncus Thomson
Caberea darwinii Busk
Aetea anguina (Linnaeus)

St. 456. 18. x. 30. 1 mile E of Bouvet Island. 40–45 m.
Himantozoum antarcticum (Calvet)

St. 474. 12. xi. 30. 1 mile W of Shag Rocks, South Georgia. 199 m.
Himantozoum antarcticum (Calvet)

St. 599. 17. i. 31. Adelaide Island, Bellingshausen Sea, 67° 08′ S, 69° 06½′ W. 203 m.
Amastigia gaussi (Kluge)
Camptoplites latus var. *striata* var.n.

St. 652. 14. iii. 31. Burdwood Bank, 54° 04′ S, 61° 40′ W. 171–169 m.
Tricellaria aculeata (d'Orbigny)

St. 724. 16. xi. 31. Fortescue Bay, Magellan Straits. 0–5 m.
Beania magellanica (Busk)

St. 929. 16. viii. 32. New Zealand, 34° 21′ S, 172° 48′ E to 34° 22′ S, 172° 49·8′ E. 58–55 m.
Menipea vectifera Harmer
Caberea zelandica (Gray)

St. 933. 17. viii. 32. New Zealand, 34° 13′ S, 172° 12′ E. 260 m.
Menipea zelandica sp.n.

St. 934. 17. viii. 32. New Zealand, 34° 11′ S, 172° 10′ E. 92–98 m.
Tricellaria monotrypa (Busk)
Emma triangula Hastings
Scrupocellaria ornithorhyncus (Thomson)
Canda arachnoides Lamouroux
Caberea helicina sp.n.
C. darwinii Busk
Caberea glabra MacGillivray
C. angusta sp.n.
Synnotum aegyptiacum (Audouin)
Beania pulchella Livingstone
Caulibugula tuberosa Hastings

At same station in 100 m.
Amastigia harmeri sp.n.
Emma triangula Hastings
Caberea boryi (Audouin)
Caberea helicina sp.n.
C. darwinii Busk
Cornucopina zelandica sp.n.

St. 935. 17. viii. 32. New Zealand, 34° 11′ S, 172° 08′ E. 84 m.
Amastigia harmeri sp.n.
Menipea zelandica sp.n.
M. vectifera Harmer
Emma triangula Hastings
Canda arachnoides Lamouroux
Caberea angusta sp.n.
Bugula cucullata var. *cuspidata* var.n.

St. 1187. 18. xi. 33. Inaccessible Island, Tristan da Cunha. 117–104 m.
Caberea rostrata Busk
Aetea anguina (Linnaeus)

At same station in 135–134 m.
Caberea rostrata Busk
Aetea anguina (Linnaeus)

St. 1230. 23. xii. 33. Magellan Strait. 27 m.
Tricellaria aculeata (d'Orbigny)

St. 1321. 16. iii. 34. West end of Magellan Strait. 66 m.
Scrupocellaria ornithorhyncus (Thomson)
Caberea darwinii Busk
Beania inermis var. *unicornis* var.n.
B. magellanica (Busk)

St. 1562. 7. iv. 35. Marion Island. 90–97 m.
Amastigia kirkpatricki Harmer
Menipea flagellifera Busk
Caberea darwinii Busk
Beania costata (Busk)

At same station in 97–104 m.
Amastigia kirkpatricki Harmer
Menipea flagellifera Busk
M. kempi sp.n.
Notoplites elongatus (Busk)
Caberea darwinii Busk
Beania magellanica (Busk)

St. 1563. 7. iv. 35. Marion Island. 101–106 m.
Amastigia kirkpatricki Harmer
Menipea flagellifera Busk
Notoplites elongatus (Busk)
Caberea darwinii Busk
Beania magellanica Busk

At same station in 113–99 m.
Amastigia kirkpatricki Harmer
Menipea flagellifera Busk
M. kempi sp.n.
Notoplites elongatus (Busk)
Caberea darwinii Busk
Beania magellanica Busk

St. 1564. 7. iv. 35. Prince Edward Island. 110–113 m.
Amastigia kirkpatricki Harmer
Menipea flagellifera Busk
Caberea darwinii Busk
Beania magellanica (Busk)

St. 1648. 18. i. 36. Off Ice Barrier, Ross Sea, 78° 18′ S, 174° 24′ W. 550 m.
Beania erecta Waters

St. 1651. 22. i. 36. Ross Sea, 77° 04·3′ S, 176° 26·1′ W. 594 m.
Notoplites tenuis (Kluge)
Beania erecta Waters
Camptoplites tricornis (Waters)

St. 1652. 23. i. 36. Ross Sea, 75° 56·2′ S, 178° 35·5′ W. 567 m.
Notoplites drygalskii (Kluge)
N. tenuis (Kluge)
Farciminellum antarcticum sp.n.
Cornucopina polymorpha (Kluge)
Beania erecta Waters
Himantozoum antarcticum (Calvet)
Camptoplites bicornis var. *compacta* (Kluge)
Camptoplites bicornis var. *magna* (Kluge)
C. lewaldi (Kluge)
C. tricornis (Waters)
C. angustus (Kluge)
C. retiformis (Kluge)
C. latus (Kluge)

St. 1658. 26. i. 36. Ross Sea, 76° 09·6′ S, 168° 40′ E. 520 m.
Notoplites drygalskii (Kluge)
Cornucopina polymorpha (Kluge)
Himantozoum antarcticum (Calvet)

St. 1660. 27. i. 36. Ross Sea, 74° 46·4′ S, 178° 23·4′ E. 351 m.
Notoplites drygalskii (Kluge)
N. tenuis (Kluge)
Caberea darwinii Busk
Farciminellum antarcticum sp.n.
Cornucopina polymorpha (Kluge)
Beania erecta Waters
Himantozoum antarcticum (Calvet)
Bugula longissima Busk
Camptoplites bicornis var. *compacta* (Kluge)
C. bicornis var. *magna* (Kluge)
C. lewaldi (Kluge)
C. tricornis (Waters)
C. angustus (Kluge)
C. retiformis (Kluge)
C. rectilinearis sp.n.

St. 1686. 4. iii. 36. Queenscliffe Jetty, Port Phillip, Victoria, 38° 16·1′ S, 144° 40·2′ E. 0 m.
Scrupocellaria ornithorhyncus Thomson
Aetea anguina (Linnaeus)
Scruparia ambigua (d'Orbigny)

St. 1872. 12. xi. 36. Near Clarence and Elephant Islands, 63° 29·6′ S, 54° 03·1′ W. 247 m.
Notoplites drygalskii (Kluge)
Himantozoum antarcticum (Calvet)

St. 1873. 13. xi. 36. Near Clarence and Elephant Islands, 61° 20·8′ S, 54° 04·2′ W. 210–180 m.
Himantozoum antarcticum (Calvet)

St. 1902. 28. xi. 36. Patagonian Shelf, 49° 48′ S, 67° 39·5′ W. 50–80–50 m.
Amastigia benemunita (Busk)
Tricellaria aculeata (d'Orbigny)
Aetea anguina (Linnaeus)
Scruparia ambigua (d'Orbigny)

St. 1909. 30. xi. 36. Burdwood Bank, 53° 53·2′ S, 60° 29·9′ W. 132 m.
Caberea darwinii Busk
Beania magellanica Busk

St. 1948. 4. i. 37. North of Clarence and Elephant Islands, 60° 49·4′ S, 52° 40′ W. 490–610 m.
Notoplites antarcticus (Waters)
Caberea darwinii Busk
Camptoplites bicornis var. *elatior* (Kluge)
Camptoplites retiformis (Kluge)
Erymophora klugei sp.n.

St. 1952. 11. i. 37. Between Penguin Island and Lion's Rump, King George Island, South Shetlands. 367–383 m.
Farciminellum antarcticum sp.n.

St. 1961. 12. ii. 37. Near Elephant and Clarence Islands, South Orkneys, 60° 49·5′ S, 45° 27·5′ W. 340 m.
Himantozoum antarcticum (Calvet)

R.S.S. 'William Scoresby'

St. WS 25. 17. xii. 26. Undine Harbour (North), South Georgia. 18–27 m.
Menipea patagonica Busk
Notoplites drygalskii (Kluge)
Caberea darwinii Busk

St. WS 27. 19. xii. 26. Off South Georgia, 53° 55′ S, 38° 01′ W. 106–109 m.
Notoplites drygalskii (Kluge)
Caberea darwinii Busk
Cornucopina pectogemma (Goldstein)
C. polymorpha (Kluge)
Beania erecta var. *livingstonei* var.n.
Himantozoum antarcticum (Calvet)
Camptoplites tricornis (Waters)

St. WS 33. 21. xii. 26. Off South Georgia, 54° 59′ S, 35° 24′ W. 130 m.

Notoplites drygalskii (Kluge)
Caberea darwinii Busk
Cornucopina pectogemma (Goldstein)
C. polymorpha (Kluge)
Himantozoum antarcticum (Calvet)
Camptoplites giganteus (Kluge)
C. tricornis (Waters)
C. retiformis (Kluge)

St. WS 42. 7. i. 27. Off South Georgia, 54° 41′ 45″ S, 36° 47′ W. 198 m.

Amastigia gaussi (Kluge)
Notoplites antarcticus (Waters)
Caberea darwinii Busk
Farciminellum antarcticum sp.n.
Cornucopina pectogemma (Goldstein)
Himantozoum antarcticum (Calvet)
Camptoplites tricornis (Waters)
C. retiformis (Kluge)
C. latus var. *aspera* var.n.

St. WS 56. 14. i. 27. Larsen Harbour, Drygalski Fjord, South Georgia. 2 m. Kelp roots.

Menipea patagonica Busk

St. WS 72. 5. iii. 27. Off Falkland Islands, 51° 07′ S, 57° 34′ W. 95 m.

Menipea patagonica Busk
Tricellaria aculeata (d'Orbigny)

St. WS 73. 6. iii. 27. Off Falkland Islands, 51° 01′ S, 58° 54′ W. 121–130 m.

Notoplites elongatus var. *calveti* var.n.

St. WS 76. 11. iii. 27. Off Patagonian Shelf, 51° S, 62° 02′ 30″ W. 207–205 m.

Amastigia benemunita (Busk)

St. WS 79. 13. iii. 27. Patagonian Shelf, 51° 01′ 30″ S, 64° 59′ 30″ W. 132–131 m.

Amastigia benemunita (Busk)
Menipea flagellifera Busk
Notoplites elongatus var. *calveti* var.n.
Tricellaria aculeata (d'Orbigny)

St. WS 80. 14. iii. 27. Patagonian Shelf, 50° 57′ S, 63° 37′ 30″ W. 152–156 m.

Amastigia benemunita (Busk)

St. WS 81. 19. iii. 27. 8 miles N 11° W of North Island, West Falkland Island. 81–82 m.

Menipea flagellifera Busk
Beania magellanica (Busk)

St. WS 82. 21. iii. 27. Burdwood Bank, 54° 06′ S, 57° 46′ W. 140–144 m.

Amastigia benemunita (Busk)
Menipea flagellifera Busk
Caberea darwinii Busk

St. WS 83. 24. iii. 27. 14 miles S 64° W of George Island, East Falkland Island. 137–129 m.

Notoplites elongatus var. *calveti* var.n.

St. WS 84. 24. iii. 27. 7½ miles S 9° W of Sea Lion Island, East Falkland Island. 75–74 m.

Amastigia nuda Busk
A. benemunita (Busk)
A. vibraculifera sp.n.
Menipea patagonica Busk
M. flagellifera Busk
Notoplites elongatus var. *calveti* var.n.
Tricellaria aculeata (d'Orbigny)
Caberea darwinii Busk
Beania inermis var. *unicornis* var.n.
B. fragilis (Ridley)
B. magellanica (Busk)
Aetea anguina (Linnaeus)

St. WS 85. 25. iii. 27. 8 miles S 66° E of Lively Island, East Falkland Island. 79 m.

Amastigia nuda Busk
A. benemunita (Busk)
A. vibraculifera sp.n.
Menipea flagellifera Busk
Notoplites elongatus var. *calveti* var.n.
Tricellaria aculeata (d'Orbigny)
Caberea darwinii Busk
Beania costata var. *maxilla* (Jullien)
B. inermis (Busk)
B. inermis var. *unicornis* var.n.
B. fragilis (Ridley)
B. magellanica (Busk)
Himantozoum obtusum sp.n.

St. WS 86. 3. iv. 27. Burdwood Bank, 53° 53′ 30″ S, 60° 34′ 30″ W. 151–147 m.
Caberea darwinii Busk

St. WS 87. 3. iv. 27. Burdwood Bank, 54° 07′ 30″ S, 58° 16′ W. 96–127 m.
Amastigia nuda Busk
A. benemunita (Busk)
Menipea patagonica Busk
Menipea flagellifera Busk
Tricellaria aculeata (d'Orbigny)
Caberea darwinii Busk

St. WS 88. 6. iv. 27. Patagonian Shelf, 54° S, 64° 57′ 30″ W. 118 m.
Amastigia benemunita (Busk)
Menipea flagellifera Busk
Notoplites elongatus var. *calveti* var.n.
Tricellaria aculeata (d'Orbigny)
Caberea darwinii Busk
Beania inermis (Busk)
B. magellanica (Busk)

St. WS 93. 9. iv. 27. 7 miles S 80° W of Beaver Island, West Falkland Island. 133–130 m.
Beania magellanica (Busk)
Himantozoum obtusum sp.n.
Camptoplites atlanticus sp.n.

St. WS 95. 17. iv. 27. Patagonian Shelf, 48° 58′ 15″ S, 64° 45′ W. 109–108 m.
Tricellaria aculeata (d'Orbigny)
Caberea darwinii Busk
Scruparia ambigua (d'Orbigny)

St. WS 128. 10. vi. 27. West side of Gough Island, inshore, 40° 19′ S, 10° 04′ W. 120–90 m.
Amastigia benemunita (Busk)

St. WS 177. 7. iii. 28. Off South Georgia, 54° 58′ S, 35° W. 97–0 m.
Himantozoum antarcticum (Calvet)

St. WS 220. 3. vi. 28. Patagonian Shelf, 47° 56′ S, 62° 38′ W. 108–104 m.
Menipea flagellifera Busk
Tricellaria aculeata (d'Orbigny)

St. WS 221. 4. vi. 28. Patagonian Shelf, 48° 23′ S, 65° 10′ W. 76–91 m.
Beania magellanica (Busk)

St. WS 222. 8. vi. 28. Patagonian Shelf, 48° 23′ S, 65° W. 100–106 m.
Tricellaria aculeata (d'Orbigny)

St. WS 225. 9. vi. 28. Patagonian Shelf, 50° 20′ S, 62° 30′ W. 162–161 m.
Menipea flagellifera Busk
Notoplites elongatus var. *calveti* var.n.
Caberea darwinii Busk
Beania magellanica (Busk)
Himantozoum obtusum sp.n.

St. WS 228. 30. vi. 28. Off Patagonian Shelf, 50° 50′ S, 56° 58′ W. 229–236 m.
Menipea flagellifera Busk
? *Cornucopina ovalis* var. *versa* var.n.
Himantozoum obtusum sp.n.

St. WS 229. 1. vii. 28. Off Patagonian Shelf, 50° 35′ S, 57° 20′ W. 210–271 m.
? *Cornucopina ovalis* var. *versa* var.n.
Beania magellanica (Busk)
Himantozoum obtusum sp.n.

St. WS 231. 4. vii. 28. Off Falkland Islands, 50° 10′ S, 58° 42′ W. 167–159 m.
Amastigia benemunita (Busk)
Menipea flagellifera Busk
Caberea darwinii Busk
Beania magellanica (Busk)
Himantozoum obtusum sp.n.
Camptoplites atlanticus sp.n.

St. WS 237. 7. vii. 28. Off Patagonian Shelf, 46° S, 60° 05′ W. 150–256 m.
Amastigia benemunita (Busk)
Menipea flagellifera Busk
Notoplites elongatus var. *calveti* var.n.
Beania magellanica (Busk)

St. WS 239. 15. vii. 28. Patagonian Shelf, 51° 10′ S, 62° 10′ W. 196–193 m.
Menipea flagellifera Busk

St. WS 243. 17. vii. 28. Patagonian Shelf, 51° 06′ S, 64° 30′ W. 144–141 m.
Amastigia benemunita (Busk)
Menipea flagellifera Busk
Notoplites elongatus var. *calveti* var.n.
Caberea darwinii Busk
Beania magellanica (Busk)

St. WS 244. 18. vii. 28. Off Patagonian Shelf, 52° S, 62° 40′ W. 253–247 m.
Amastigia benemunita (Busk)
Menipea flagellifera Busk
Notoplites elongatus var. *calveti* var.n.
Tricellaria aculeata (d'Orbigny)

St. WS 245. 18. vii. 28. Off Patagonian Shelf, 52° 36′ S, 63° 40′ W. 340–290 m.
Amastigia gaussi (Kluge)
A. benemunita (Busk)
Menipea flagellifera Busk
Notoplites elongatus var. *calveti* var.n.
Tricellaria aculeata (d'Orbigny)

St. WS 246. 19. vii. 28. Off Patagonian Shelf, 52° 25′ S, 61° W. 267–208 m.
Amastigia benemunita Busk
Menipea flagellifera Busk
? *Cornucopina ovalis* var. *versa* var.n.
Himantozoum obtusum sp.n.

St. WS 247. 19. vii. 28. Off Falkland Islands, 52° 40′ S, 60° 05′ W. 172 m.
Notoplites elongatus var. *calveti* var.n.
Caberea darwinii Busk

St. WS 249. 20. vii. 28. Off Falkland Islands, 52° 10′ S, 57° 30′ W. 166 m.
Himantozoum obtusum sp.n.

St. WS 755. 21. ix. 31. Off Falkland Islands, 51° 39′ S, 57° 39′ W. 77 m.
Amastigia benemunita (Busk)
Caberea darwinii Busk
Beania magellanica (Busk)

St. WS 765. 17. x. 31. Patagonian Shelf, 45° 07′ S, 60° 28′ 15″ W. 113–118 m.
Amastigia benemunita (Busk)

St. WS 773. 31. x. 31. Off Patagonian Shelf, 47° 28′ S, 60° 51′ W. 291–296 m.
Camptoplites atlanticus sp.n.

St. WS 776. 3. xi. 31. Patagonian Shelf, 46° 18′ 15″ S, 65° 02′ 15″ W. 107–99 m.
Amastigia benemunita (Busk)
Bicellariella sp.
Beania inermis var. *unicornis* var.n.

St. WS 781. 6. xi. 31. Off Falkland Islands, 50° 30′ S, 58° 50′ W. 148 m.
Amastigia benemunita (Busk)
Notoplites elongatus var. *calveti* var.n.

St. WS 783. 5. xii. 31. Off Falkland Islands, 50° 08′ S, 59° 50′ W. 155 m. Haul I.
Himantozoum obtusum sp.n.

St. WS 784. 5. xii. 31. Patagonian Shelf, 49° 47′ 45″ S, 61° 05′ W. 170–164 m.
Beania magellanica (Busk)

St. WS 794. 17. xii. 31. Patagonian Shelf, 46° 12′ 37″ S, 60° 59′ 15″ W. 123–126 m.
Notoplites elongatus var. *calveti* var.n.

St. WS 824. 19. i. 32. Off Falkland Islands, 50° 29′ 15″ S, 58° 27′ 15″ W. 146–137 m.
Menipea flagellifera Busk
Notoplites elongatus var. *calveti* var.n.
Camptoplites atlanticus sp.n.

St. WS 825. 28/29. i. 32. Off Falkland Islands, 50° 50′ S, 57° 15′ 15″ W. 135–144 m.
Notoplites elongatus var. *calveti* var.n.
Beania magellanica (Busk)

St. WS 836. 3. ii. 32. Patagonian Shelf, 53° 05′ 30″ S, 67° 38′ W. 64 m.
Amastigia benemunita (Busk)

St. WS 838. 5. ii. 32. Patagonian Shelf, 53° 11′ 45″ S, 65° W. 148–159 m.
Amastigia benemunita (Busk)
Menipea flagellifera Busk
Tricellaria aculeata (d'Orbigny)
Beania magellanica (Busk)

St. WS 840. 6. ii. 32. Off Patagonian Shelf, 53° 52′ S, 61° 49′ 15″ W. 368–463 m.
Amastigia crassimarginata (Busk)
Caberea darwinii var. *guntheri* var.n.
Cornucopina ovalis var. *versa* var.n.
Camptoplites asymmetricus sp.n.

St. WS 847. 9. ii. 32. Patagonian Shelf, 50° 15′ 45″ S, 67° 57′ W (haul A), 50° 18′ 45″ S, 67° 44′ W (haul B). 51–56 m.
Tricellaria aculeata (d'Orbigny)
Caberea darwinii Busk
Aetea anguina (Linnaeus)
Scruparia ambigua (d'Orbigny)

St. WS 871. 1. iv. 32. Off Patagonian Shelf, 53° 16′ S, 64° 12′ W. 336–341 m.
Amastigia benemunita (Busk)
Menipea flagellifera Busk
Tricellaria aculeata (d'Orbigny)
Caberea darwinii var. *guntheri* var.n.
Cornucopina ovalis var. *versa* var.n.
Himantozoum obtusum sp.n.
Camptoplites bicornis var. *quadriavicularis* var.n.

Marine Biological Station

St. MS 14. 17. ii. 25. South Georgia, from 1·5 miles SE by S to 1·5 miles S ½° W of Sappho Point, East Cumberland Bay. 190–110 m.
Caberea darwinii Busk

St. MS 64. 24. ii. 26. South Georgia, 1·8 miles SE by S of King Edward Point Light, East Cumberland Bay. 15–7 m.
Caberea darwinii Busk

St. MS 65. 28. ii. 26. South Georgia, East Cumberland Bay, 1·6 miles SE of Hobart Rock to 1 cable N of Dartmouth Point. 39 m.
Menipea patagonica Busk

St. MS 68. 2. iii. 26. South Georgia, East Cumberland Bay, 1·7 miles S ½° E to 8½ cables SE by E of Sappho Point. 220–247 m.
Camptoplites tricornis (Waters)

St. MS 71. 9. iii. 26. South Georgia, East Cumberland Bay, 9¼ cables E by S to 1·2 miles E by S of Sappho Point. 110–60 m.
Amastigia gaussi (Kluge)
Camptoplites retiformis (Kluge)

St. MS 82. 6. ix. 26. Saldanha Bay, South Africa, off Salamander Point. 7–14 m.
Bugula calathus Norman

Unnumbered 'Discovery' Stations

Deception Island, South Shetlands. 1924. 46–55 m. dredged.
Camptoplites bicornis var. *magna* (Kluge)
Camptoplites angustus (Kluge)

South Africa, outside Saldanha Bay, sea beach. 1926.
Menipea crispa (Pallas)
Menipea triseriata Busk

BRITISH ANTARCTIC ('TERRA NOVA') EXPEDITION, 1910

See Harmer, S. F. & Lillie, D. G. (1914). *List of Collecting Stations. British Antarctic (Terra Nova) Exped.* 1910. Zoology, II.

St. TN 36. 26 July 1910. South Trinidad Island. Between tide-marks.
Scrupocellaria ornithorhyncus Thomson
Caberea glabra MacGillivray

St. TN 90. 25 July 1911. New Zealand, from Summit, Great King, Three Kings Islands, S 14° W, 8 miles. 183 m.
Cornucopina moluccensis (Busk)
Cornucopina zelandica sp.n.

St. TN 91. 26 July 1911. New Zealand, from Summit, Great King, Three Kings Islands, S 10° W, 25 miles. 549 m.

Caberea helicina sp.n.
Cornucopina moluccensis (Busk)

St. TN 134. 31 August 1911. New Zealand, Spirits Bay, near North Cape. 20–37 m.

Caberea rostrata Busk
Beania discodermiae (Ortmann)
B. intermedia (Hincks)
Bugula expansa Hastings
Scruparia ambigua (d'Orbigny)

St. TN 144. 13 September 1911. New Zealand, from Cape Maria van Diemen, W by S, 7 miles (true bearing). 64–73 m.

Tricellaria monotrypa (Busk)
Emma triangula Hastings
Caberea zelandica Gray
C. glabra MacGillivray
Caberea sp. indet.
Cornucopina zelandica sp.n.
Bugula cucullata var. *cuspidata* var.n.
Dimetopia cornuta Busk

St. TN 194. 22 February 1911. Off Oates Land, 69° 43′ S, 163° 24′ E. 329–366 m.

Amastigia gaussi (Kluge)
A. cabereoides (Kluge)
A. antarctica (Kluge)
A. solida (Kluge)
Notoplites antarcticus (Waters)
N. watersi (Kluge)
N. drygalskii (Kluge)
N. vanhöffeni (Kluge)
N. tenuis (Kluge)
N. tenuis var. *uniserialis* var.n.
Caberea darwinii Busk
Farciminellum antarcticum sp.n.
Cornucopina pectogemma (Goldstein)
Cornucopina polymorpha (Kluge)
C. lata (Kluge)
Beania erecta var. *livingstonei* var.n.
B. scotti sp.n.
Klugella echinata (Kluge)
Himantozoum antarcticum (Calvet)
Camptoplites tricornis (Waters)
C. angustus (Kluge)
C. retiformis (Kluge)
C. areolatus (Kluge)
Erymophora klugei sp.n.
Brettia triplex sp.n.

St. TN 220. 3 January 1912. Off Cape Adare, mouth of Robertson's Bay. 82–92 m.

Notoplites drygalskii (Kluge)
Cornucopina pectogemma (Goldstein)
Cornucopina polymorpha (Kluge)
Beania erecta var. *livingstonei* var.n.

St. TN 294. 15 January 1913. Ross Sea, 74° 25′ S, 179° 3′ E. 289 m.

Bugula longissima Busk

St. TN 314. 23 January 1911. 5 miles N of Inaccessible Island, McMurdo Sound. 406–441 m.

Amastigia antarctica (Kluge)
Notoplites drygalskii (Kluge)
Cornucopina polymorpha (Kluge)
Camptoplites bicornis var. *compacta* (Kluge)
Camptoplites bicornis var. *magna* (Kluge)
C. tricornis (Waters)
C. angustus (Kluge)
C. rectilinearis sp.n.

St. TN 316. 9 February 1911. Off Glacier Tongue, about 8 miles N of Hut Point, McMurdo Sound. 348–457 m.

Amastigia antarctica (Kluge)
Notoplites drygalskii (Kluge)
Caberea darwinii Busk
Cornucopina pectogemma (Goldstein)
Beania erecta var. *livingstonei* var.n.
Klugella echinata (Kluge)
Himantozoum antarcticum (Calvet)
Camptoplites tricornis (Waters)
C. latus (Kluge)

St. TN 321. 13–17 August 1911. In contraction-crack between Inaccessible Island and Barne Glacier. 180–250 m.

Caberea darwinii Busk

St. TN 331. 14 January 1912. Off Cape Bird Peninsula, entrance to McMurdo Sound. 457 m.
Notoplites drygalskii (Kluge)
Beania erecta var. *livingstonei* var.n.
Himantozoum antarcticum (Calvet)

St. TN 338. 23 January 1912. Ross Sea, 77° 13′ S, 164° 18′ E. 379 m.
Farciminellum antarcticum sp.n.

St. TN 339. 24 January 1912. Ross Sea, 77° 5′ S, 164° 17′ E. 256 m.
Amastigia antarctica (Kluge)
Notoplites drygalskii (Kluge)
N. vanhöffeni (Kluge)
N. tenuis (Kluge)
Caberea darwinii Busk
Beania erecta Waters
Himantozoum antarcticum (Calvet)
Camptoplites bicornis var. *compacta* (Kluge)
C. bicornis var. *magna* (Kluge)
C. tricornis (Waters)
C. angustus (Kluge)
C. retiformis (Kluge)
C. latus (Kluge)
C. rectilinearis sp.n.

St. TN 340. 25 January 1912. Ross Sea, 76° 56′ S, 164° 12′ E. 293 m.
Notoplites drygalskii (Kluge)
N. tenuis (Kluge)
Caberea darwinii Busk
Farciminellum antarcticum sp.n.
Himantozoum antarcticum (Calvet)
Camptoplites bicornis var. *compacta* (Kluge)
C. giganteus (Kluge)
C. tricornis (Waters)
C. angustus (Kluge)

St. TN 348. 13 February 1912. Off Barne Glacier, McMurdo Sound. 366 m.
Notoplites vanhöffeni (Kluge)
Camptoplites retiformis (Kluge)

St. TN 355. 20 January 1913. Antarctic, 77° 46′ S, 166° 8′ E. 549 m.
? *Notoplites drygalskii* (Kluge)
Camptoplites tricornis (Waters)
Camptoplites retiformis (Kluge)

St. TN [unnumbered]. 23 August [year ?]. Doubtless Bay, Mongonui, New Zealand. 12 fm.
Emma triangula Hastings

NATIONAL ANTARCTIC EXPEDITION, 1901–1904

S.S. '*Discovery*'

For maps see: *Reports National Antarctic Expedition*, 1901–4, Natural History, I, 1907. British Museum (Natural History).

The Polyzoa of the National Antarctic Expedition have passed through the hands of several workers, and it is therefore not surprising that some of the labels are incomplete or show discrepancies. As there is no station list from which these labels can be checked and amplified, I have consulted some manuscript notes made by Mr T. V. Hodgson, naturalist to the expedition, and compiled the chronological statement given below, which only includes stations that yielded Polyzoa.

A. *Outward voyage.*

9. i. 02. Cape Adare, 18 fm.
No Cellularine Polyzoa obtained.

13. i. 02. Off Coulman Island, 100 fm.
No Cellularine Polyzoa obtained.

15. i. 02. Cape Wadsworth, Coulman Island, 8–15 fm.
No Cellularine Polyzoa obtained.

27. i. 02. Off Barrier, 300 fm. (The map of the voyage shows that on this date the ship was off the Great Ice Barrier in 174° W.)
Notoplites drygalskii (Kluge)

29. i. 02. East end of Barrier, 100 fm. (The map of the voyage shows that this was in 162½° W.)

Notoplites drygalskii (Kluge)
N. tenuis (Kluge)
Beania erecta Waters
Camptoplites lewaldi (Kluge)
C. angustus (Kluge), young colony only.

B. *Winter Quarters, McMurdo Sound.*

(*a*) 8. ii. 02–21. iii. 02. Collections made within 20 fm. line with small dredge from whaler before ship became frozen in.

Notoplites drygalskii (Kluge)
N. tenuis (Kluge)
Caberea darwinii Busk
Camptoplites lewaldi (Kluge)
C. tricornis (Waters)

(*b*) Collections made through holes in the ice (either seal-holes enlarged by digging, or holes specially dug). The following yielded Polyzoa during the periods specified:

7. viii. 02. 178 fm. (No locality given, the depth corresponds to No. 5 hole in Hodgson's MS.)
No Cellularine Polyzoa obtained.

13. ix. 02–8. xi. 02. Cape Armitage. 100 fm.
Notoplites vanhöffeni (Kluge)

13. ix. 02–19. xi. 02. Hut Point. 12–20 fm.[1]
No Cellularine Polyzoa obtained.

13. x. 02–27. xii. 02. No. 4 hole. 500 yards SSE of Hut Point. 41 fm.
No Cellularine Polyzoa obtained.

14. i. 03–8. iv. 03. No. 6 hole. 3000 yards SSE of Hut Point. 124 or 130 fm.
Notoplites drygalskii (Kluge)
N. vanhöffeni (Kluge)
N. tenuis var. *uniserialis* var.n.
Caberea darwinii Busk
Camptoplites bicornis var. *magna* (Kluge)

22. iv. 03–2. vi. 03. No. 10 hole. 3500 yards SSE of Hut Point. 130 fm.
Amastigia antarctica (Kluge)
Notoplites watersi (Kluge)
N. drygalskii (Kluge)
N. tenuis var. *uniserialis* var.n.
Notoplites klugei (Hasenbank)
Caberea darwinii Busk
Camptoplites bicornis var. *magna* (Kluge)
C. angustus (Kluge)

29. iv. 03. No. 11 hole. 300 yards SSE of Hut Point. 28 fm.
Notoplites tenuis (Kluge)

20. viii. 03–30. ix. 03. No. 12 hole. 25–30 fm.
Notoplites tenuis (Kluge)
Caberea darwinii Busk

2. i. 04. Hole (unnumbered). 180 fm.
No Cellularine Polyzoa obtained.

3. i. 04. Tent Island. 5–20 fm.
No Cellularine Polyzoa obtained.

C. *Homeward voyage.*

4. iii. 04. 67° 21′ 46″ S, 155° 21′ 10″ E. 256 and 354 fm.
(Depths taken from published map of voyage. Polyzoa labels give 250 and 254 fm. respectively.)
No Cellularine Polyzoa obtained.

19. iii. 04. Port Rosa, Auckland Island.
Tricellaria aculeata Busk

26. iii. 04. Laurie Harbour.
No Cellularine Polyzoa obtained.

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[1] Depth taken from letter from Hodgson to Kirkpatrick, 19. vii. 1905.

SHACKLETON-ROWETT ('QUEST') EXPEDITION

South Georgia, May 1922.

Amastigia gaussi (Kluge)
Notoplites antarcticus (Waters)
Caberea darwinii Busk
Beania erecta var. *livingstonei* var.n.
Himantozoum antarcticum (Calvet)
Camptoplites giganteus (Kluge)
? *C. latus* var. *aspera* var.n.

LIST OF SPECIES DISCUSSED

SCRUPOCELLARIIDAE

Amastigia Busk, 1852 page 320
- 1. *A. nuda* Busk 321
- 2. *A. harmeri* sp.n. 322
- 3. *A. gaussi* (Kluge) 322
- 4. *A. benemunita* (Busk) 325
- 5. *A. kirkpatricki* Harmer 327
- 6. *A. cabereoides* (Kluge) 327
- 7. *A. vibraculifera* sp.n. 327
- 8. *A. antarctica* (Kluge) 329
- 9. *A. pateriformis* (Busk) 330
- 10. *A. solida* (Kluge) 330
- 11. *A. crassimarginata* (Busk) 331
- 12. *A. abyssicola* (Kluge) 331

Menipea Lamouroux, 1812 331
- 1. *M. crispa* (Pallas) 332
- 2. *M. patagonica* Busk 333
- 3. *M. flagellifera* Busk 335
- 4. *M. kempi* sp.n. 336
- 5. *M. triseriata* Busk 337
- 6. *M. quadrata* (Busk) 337
- 7. *M. zelandica* sp.n. 337
- 8. *M. vectifera* Harmer 339

Notoplites Harmer, 1923 339
- 1. *N. antarcticus* (Waters) 341
- 2. *N. watersi* (Kluge) 342
- 3. *N. drygalskii* (Kluge) 342
- 4. *N. vanhöffeni* (Kluge) 346
- 5. *N. elongatus* (Busk) 346
- 6. *N. elongatus* var. *calveti* var.n. 348
- 7. *N. tenuis* (Kluge) 350
- 8. *N. tenuis* var. *uniserialis* var.n. 351
- 9. *N. klugei* (Hasenbank) 352
- 10. *N. crassiscutus* sp.n. 353
- 11. *N. perditus* (Kluge) 355

Tricellaria Fleming, 1828 356
- 1. *T. monotrypa* (Busk) 356
- 2. *T. aculeata* (d'Orbigny) 356
- 3. *Tricellaria* sp. 359

Emma Gray, 1843 360
- 1. *E. triangula* Hastings 360

Scrupocellaria Van Beneden, 1845 360
- 1. *S. ornithorhyncus* Thomson 360
- 2. *S. frondis* Kirkpatrick 361

Canda Lamouroux, 1816 364
- 1. *C. arachnoides* Lamouroux 364

Caberea Lamouroux, 1816 page 365
- 1. *C. boryi* (Audouin) 367
- 2. *C. helicina* sp.n. 368
- 3. *C. zelandica* (Gray) 371
- 4. *C. darwinii* Busk 374
- 5. *C. darwinii* var. *occlusa* var.n. 385
- 6. *C. darwinii* var. *guntheri* var.n. 386
- 7. *C. angusta* sp.n. 389
- 8. *C. rostrata* Busk 389
- 9. *Caberea* sp. 390

EPISTOMIIDAE

Synnotum Pieper, 1881 391
- 1. *S. aegyptiacum* (Audouin) 391

FARCIMINARIIDAE

Farciminellum Harmer, 1926 391
- 1. *F. antarcticum* sp.n. 391
- 2. *F. hexagonum* (Busk) 393
- 3. *F. lineare* (Kluge) 393

Levinsenella Harmer, 1926 393
- 1. *L. magna* (Busk) 393

Kenella Levinsen, 1909 394
- 1. *K. biseriata* (Busk) 394

BICELLARIELLIDAE

Bicellariella Levinsen, 1909 396
- 1. *Bicellariella* sp. 396

Cornucopina Levinsen, 1909 396
- 1. *C. pectogemma* (Goldstein) 397
- 2. *C. conica* Harmer 398
- 3. *C. infundibulata* (Busk) 399
- 4. *C. polymorpha* (Kluge) 399
- 5. *C. lata* (Kluge) 402
- 6. *C. ovalis* sp.n. 402
- 7. *C. ovalis* var. *versa* var.n. 404
- 8. *C. zelandica* sp.n. 405
- 9. *C. moluccensis* (Busk) 406
- 10. *C. angulata* (Kluge) 406
- 11. *C. rotundata* (Kluge) 406

Beania Johnston, 1840 408
- 1. *B. costata* (Busk) 408
- 2. *B. costata* var. *maxilla* (Jullien) 409
- 3. *B. discodermiae* (Ortmann) 410

4. *Beania inermis* (Busk) *page* 411
5. *B. inermis* var. *unicornis* var.n. 412
6. *B. fragilis* (Ridley) 413
7. *B. pulchella* Livingstone 414
8. *B. magellanica* (Busk) 414
9. *B. challengeri* sp.n. 415
10. *B. erecta* Waters 416
11. *B. erecta* var. *livingstonei* var.n. 417
12. *B. scotti* sp.n. 418
13. *B. intermedia* (Hincks) 419
Klugella gen.n. 420
1. *K. echinata* (Kluge) 421
2. *K. buski* nom.n. for *Flustra crassa* Busk 422
Himantozoum Harmer, 1923 422
1. *H. antarcticum* (Calvet) 422
2. *H. obtusum* sp.n. 424
3. *H. sinuosum* (Busk) 425
4. *H. sinuosum* var. *variabilis* (Kluge) 426
Bugula Oken 1815 426
1. *B. calathus* Norman 426
2. *B. cucullata* var. *cuspidata* var.n. 427
3. *B. dentata* (Lamouroux) 429
4. *B. hyadesi* Jullien 430
5. *B. neritina* (Linnaeus) 430
6. *B. longissima* Busk 431
Caulibugula Verrill 1900 433
1. *C. tuberosa* Hastings 433
Kinetoskias Daniellsen, 1868 433
1. *K. pocillum* Busk 433
Camptoplites Harmer 1923 433
1. *C. bicornis* (Busk) 443
2. *C. bicornis* var. *compacta* (Kluge) 445
3. *Camptoplites bicornis* var. *magna* (Kluge) *page* 445
4. *C. bicornis* var. *elatior* (Kluge) 447
5. *C. bicornis* var. *quadriavicularis* var.n. 447
6. *C. lewaldi* (Kluge) 449
7. *C. giganteus* (Kluge) 451
8. *C. tricornis* (Waters) 451
9. *C. abyssicolus* (Kluge) 452
10. *C. angustus* (Kluge) 452
11. *C. retiformis* (Kluge) 453
12. *C. retiformis* var. *tenuispina* var.n. 455
13. *C. latus* (Kluge) 458
14. *C. latus* var. *striata* var.n. 458
15. *C. latus* var. *aspera* var.n. 458
16. *C. atlanticus* sp.n. 460
17. *C. rectilinearis* sp.n. 462
18. *C. reticulatus* (Busk) 462
19. *C. lunatus* Harmer 464
20. *C. areolatus* (Kluge) 465
21. *C. asymmetricus* sp.n. 466
Erymophora gen.n. 469
1. *E. gracilis* (Nichols) 470
2. *E. klugei* sp.n. 470

AETEIDAE

Aetea Lamouroux 1812 471
1. *A. anguina* (Linnaeus) 471
2. *A. curta* Jullien 473

SCRUPARIIDAE

Scruparia Oken 1815 475
1. *S. ambigua* (d'Orbigny) 475
Brettia Dyster 1858 476
1. *B. inornata* (Goldstein) 476
2. *B. triplex* sp.n. 476

SYSTEMATIC DESCRIPTIONS

In the statements of Station Distribution, showing the stations from which each species was obtained by the Discovery Investigations, the stations have been grouped according to the areas recognized in Table 3, p. 479. Particulars of the stations with lists of the species obtained from each are given on p. 305.

The geographical distribution of the species has been stated in general terms. The term "Patagonian Shelf" covers the region east of the Patagonian coast down to 200 m., and includes the Falkland Islands and the Burdwood Bank (see map, Fig. 60). Stations below 200 m. in this region are recorded as "off Patagonian Shelf". The channels around Tierra del Fuego, from the Straits of Magellan to Cape Horn, appear as the "Magellanic Region". "Ross Sea" includes McMurdo Sound.

Unless otherwise stated the figures have been drawn by means of a camera lucida from specimens mounted in canada balsam and seen by transmitted light. In many of the figures drawn in this way the opesia has been arbitrarily stippled for clarity.

Definitions of the families represented in this report are given by Harmer (1926).

KEY TO THE GENERA OF SCRUPOCELLARIIDAE DISCUSSED HERE

Definitions of the genera of this family are given by Harmer (1923 and 1926), and should be consulted as the genera are recognized on the sum of many characters, few of which are constant throughout the genus, and the following key is therefore unsatisfactory.

1. Basal heterozooecia vibracula covering greater part of basal surface ... ... Caberea
   Basal heterozooecia, when present, avicularia, or vibracula covering only a small part of the basal surface 2
2. Inner series of zooecia (when colony pluriserial) tend to be excluded from basal surface. True joints with chitinous tubes[1] absent except in *A. kirkpatricki* (which is biserial) ... ... Amastigia
   Inner series of pluriserial colonies reach basal surface normally. True joints present except in some pluriserial *Menipea* spp. 3
3. Colony biserial. Basal heterozooecia vibracula, usually present 4
   Colony biserial or pluriserial. Basal heterozooecia avicularia when present 5
4. Branches connected by cross-rootlets which join two vibracula. Joint crosses opesia of inner zooecium ... ... Canda
   Cross-rootlets rarely present and only attached to a vibraculum at one end. Joint crosses opesia of outer zooecium ... ... Scrupocellaria
5. Zooecia grouped in short internodes frequently of only two or three zooecia. No basal heterozooecia. Bifurcation of types 9–14 (see Harmer, 1923) 6
   Zooecia form longer internodes. Basal heterozooecia avicularia, when present. Bifurcation of types 15, 17 or 18 7
6. Cryptocyst not extensive. Bifurcation of types 9–12 ... ... Tricellaria
   Cryptocyst extensive.[2] Bifurcation of types 13 or 14 ... ... Emma
7. Bifurcation of type 15. Scutum present or absent. Basal avicularia usually axillary when present ... ... Notoplites
   Bifurcation of types 17 or 18. Scutum absent. Basal avicularia absent except in *M. vectifera* ... ... Menipea

Amastigia Busk 1852

Key to the recent species

In this key I have omitted *Amastigia abyssicola* (Kluge), a deep-water Antarctic species which I have not seen (see p. 331). Some fossil species are known (see p. 496).

1. Heterozooecia present 2
   Heterozooecia absent ... ... Amastigia sp.[3]
2. Basal heterozooecia present 3
   Basal heterozooecia absent ... ... A. funiculata[4]
3. Mandible of basal heterozooecium more or less setiform 4
   Mandible of basal heterozooecium not setiform 12

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[1] See Harmer (1923, p. 32).

[2] Except in *E. cyathus*, see p. 358.

[3] Described under *A. kirkpatricki*, p. 327.

[4] For the species of *Amastigia* not discussed in this report see Harmer (1923).

4. Seta truly vibracular (i.e. asymmetrical at base with movement in more than two directions) ... 5
Seta an elongate avicularian mandible (i.e. symmetrical at base with opening and shutting movement only) ... 9

5. Gigantic frontal avicularia present, branches (in part at least) with more than two series of zooecia ... 6
Gigantic avicularia absent, branches biserial, except for median zooecium at bifurcation ... 11. **A. crassimarginata**

6. Gigantic avicularia on marginal zooecia only, numerous ... **A. rudis**[1]
Gigantic avicularia chiefly on inner zooecia, few ... 7

7. True joints regularly present at bifurcation, crossing opesia of outer zooecium, scutum absent ... 5. **A. kirkpatricki**
Joints, when present, of secondary "fracture" type, scutum present ... 8

8. Branches 3- to 6-serial (except at base of colony), zooecia relatively short, scutum pear-shaped, spines on marginal zooecia 4 : 1 ... 7. **A. vibraculifera**
Branches 2- to 4-serial, zooecia relatively long, scutum with more marked distal and proximal lobes, spines on marginal zooecia 2 (rarely 3) : 1 ... 6. **A. cabereoides**

9. Scutum absent, frontal avicularia rather conspicuous... 10
Scutum present, frontal avicularia not conspicuous ... 11

10. Frontal avicularia all unpaired ... 9. **A. pateriformis**
Frontal avicularia paired on inner zooecia ... 8. **A. antarctica**

11. Scutum with indented margin, branches 2–4 serial, cryptocyst wide ... 10. **A. solida**
Scutum with smooth margin and prominent truncate distal lobe, branches with 3–7, or more, series of zoœcia, cryptocyst moderate ... 4. **A. benemunita**

12. Spines small and inconspicuous, except a few extremely large ones constricted at base, zooecia and ovicells long ... 3. **A. gaussi**
Spines usually fairly stout and conspicuous but none gigantic, zooecia and ovicells not particularly long ... 13

13. Blade of scutum round, inner zooecia taking very small part in formation of basal wall and completely excluded in some branches, frontal surface correspondingly convex ... 2. **A. harmeri**
Scutum with long proximal lobe, inner rows contributing more to basal surface and never completely excluded, frontal surface flatter than in *A. harmeri* ... 1. **A. nuda**

1. Amastigia nuda Busk. Figs. 1 B, 2 D, E.

Amastigia nuda Busk, 1852*b*, p. 40, pl. xxxvi, figs. 4, 5; Calvet, 1904, p. 7; part Harmer, 1923, p. 330, pl. xvii, fig. 24.

Menipea benemunita Busk (part), 1884, p. 19 (specimens from Chall. St. 149, Kerguelen).

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. WS 84, WS 85, WS 87.

GEOGRAPHICAL DISTRIBUTION. Magellanic Region (Busk; Calvet); Patagonian Shelf (Discovery); Kerguelen (Harmer).

Reasons are given (p. 322) for regarding the nearly related Australian form as a species (*Amastigia harmeri*) distinct from *A. nuda*.

One Challenger Kerguelen colony (87.12.9.68) is a typical specimen of *A. nuda*, and additional typical material from the same station has recently been recognized (35.3.12.1). Another Challenger colony from Kerguelen (87.12.9.75) approaches

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[1] For the species of *Amastigia* not discussed in this report see Harmer (1923).

A. gaussi (Kluge) (see below) in the length of the zooecia, but agrees with *A. nuda* in the size and number of its spines and the absence of giant spines. In this specimen one of the distal spines commonly curves over the aperture, following the outline of the distal border of the scutum. Hasenbank's supposed specimen of *A. nuda* (1932, p. 362) from Bouvet Island clearly belonged to *A. gaussi*. Calvet unfortunately gave no description, but his specimen came from the region of the type-locality of *A. nuda* and presumably belonged to that species.

A median, longitudinal, basal heterozooecium is sometimes present before a bifurcation both in the type and in the present material. It is similar in shape to the lateral basal heterozooecia (Figs. 2 D, E; see p. 325).

2. Amastigia harmeri sp.n.

Amastigia nuda MacGillivray, 1887*b*, p. 200 [not *A. nuda* Busk, 1852]; part Harmer, 1923, p. 330, pl. xvii, figs. 21, 25, pl. xix, figs. 50, 51; Livingstone, 1929, p. 54.

STATION DISTRIBUTION. *New Zealand:* Sts. 934, 935.

GEOGRAPHICAL DISTRIBUTION. Victoria (MacGillivray; Harmer); New Zealand (Livingstone; Discovery).

HOLOTYPE. Port Phillip Heads. Bracebridge Wilson Collection, 97.5.1.246. Figured by Harmer.

With the exception of Fig. 24, Harmer's drawings of *Amastigia nuda* all represent the Victorian form, which, now that a little more material of the true South American *A. nuda* is available, is found to show certain constant differences and is here regarded as a distinct species, *A. harmeri*. Harmer's figs. 49 and 50 show the characteristic scutum which is rounded, with the proximal lobe not much larger than the distal. The lumen is narrow and runs across the scutum in a line with the stalk, widening more or less at the edge.

In the type and other South American specimens of *A. nuda* the proximal lobe of the scutum is longer and the lumen extends into it (Fig. 1 B). The cryptocyst of *A. harmeri* is wider than that of *A. nuda* and is more granular. Another difference which appears to be constant is the greater size, and particularly width, of the uncalcified frontal area in the ectooecium in *A. harmeri*. The difference in the basal surface of the branch is less sharply defined, but on the whole the inner rows contribute less to its formation in *A. harmeri*, and there are nearly always some branches in which the basal surface is formed entirely by the marginal zooecia. The greater part played by the marginal zooecia in forming the basal surface results in their outer edges being turned more basally so that the marginal avicularia, when present, are also directed more or less basally instead of laterally. The differences are slight, but, as far as the evidence goes, definite.

It may reasonably be assumed that Livingstone's specimens from New Zealand belonged to *A. harmeri*.

3. Amastigia gaussi (Kluge). Figs. 1 A, C.

Scrupocellaria gaussi Kluge, 1914, p. 609, pl. xxvii, figs. 9, 10 [not figs. 3 and 4].

Amastigia gaussi Harmer, 1923, p. 338.

Amastigia nuda Hasenbank, 1932, p. 362.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, St. WS 245. *Antarctic:* Weddell Quadrant, Sts. 27, 39, 42, 140, 149, 153, 159, 167, 180, 190, 599, WS 42, MS 71.

GEOGRAPHICAL DISTRIBUTION. Off Patagonian Shelf, below 300 m. (Discovery); South Georgia (Shackleton-Rowett Expedition; Discovery); Bouvet Island (Hasenbank); South Orkney Islands; Palmer Archipelago; Adelaide Island (Discovery); Wilhelm II Land (Kluge); Oates Land (Terra Nova).

Comparison of Kluge's description and figures shows that figs. 3 and 4, on pl. xxvii, represent *Amastigia cabereoides* and figs. 9 and 10 *A. gaussi*, not the reverse as indicated. Harmer (1923, pp. 335, 338) apparently overlooked this, consequently describing the scutum and basal heterozooecium of *A. gaussi* under *A. cabereoides*, and mentioning *A. gaussi*, instead of *A. cabereoides*, as being related to *A. kirkpatricki*.

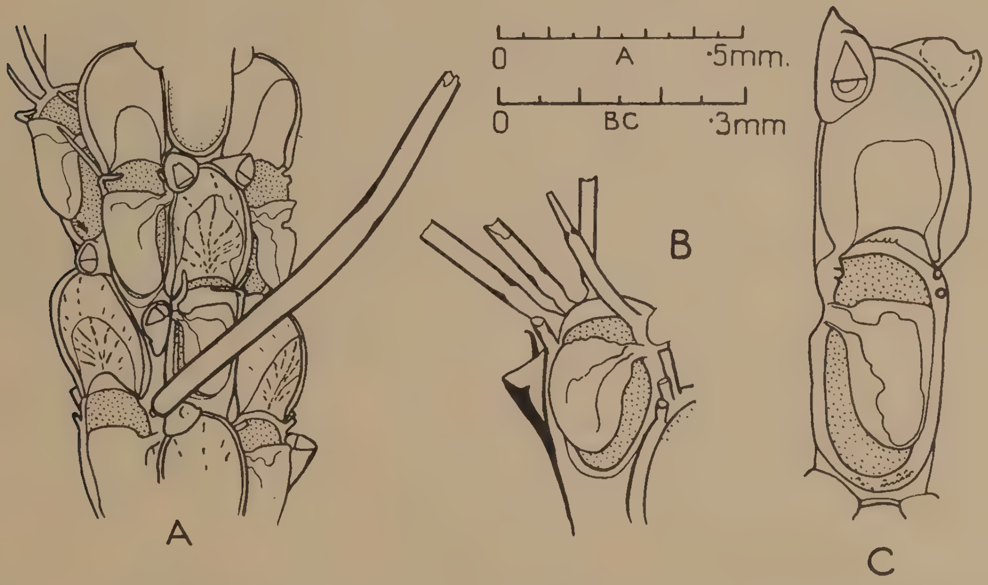

Fig. 1. A. *Amastigia gaussi* (Kluge). 23.12.1.28. South Georgia. To show giant spine and small size of other spines. B. *A. nuda* Busk. St. WS 84, Falkland Islands. One zooecium from a colony found attached to the limb of a Pycnogon (*Pallenopsis glabra*). C. *A. gaussi* (Kluge). St. 140, South Georgia. A fertile zooecium from one of the inner rows in slightly oblique view. One of the avicularia distal to the ovicell is broken.

A. gaussi is closely related to *A. nuda* (cf. Fig. 1 A, C with B) from which it is distinguished by its long zooecia, with long gymnocyst, long opesia, and correspondingly long proximal lobe to the scutum, and by its long straight-sided ovicells. Spines are on the whole less numerous. For example, 2 : 1 as noted by Kluge is common on marginal zooecia, though 3 : 1 is not infrequent, but 4 : 2 (a common but by no means constant number in *A. nuda*) has not been found. Most of the spines are small and very inconspicuous, but in every specimen I have examined (with the exception of a few small fragments) a few of the inner spines are of gigantic size, much larger than any found in *A. nuda*. These gigantic spines have a slender base and widen suddenly. The spines of

A. nuda do not have this very marked basal constriction. Most of them are moderately long and stout, so that, in spite of the absence of the gigantic ones, the species usually looks more spiny than *A. gaussi*, its appearance being well shown in Busk's figure. Even when the gigantic spines of *A. gaussi* are broken off the shape of the remaining basal portion is characteristic. A difference in the size of the basal avicularia of the two species is noticeable, but, as many instances of variation in size within a species are known, this difference is probably not of systematic value. The distal wall of the fertile zooecium of *A. gaussi* commonly bears a few teeth directed towards the ovicell (Fig. 1 C), but they may be absent, or only represented by a single tooth. Such teeth have not been seen in *A. nuda*. From his description of the scutum, the spines and the ovicell it is clear that Hasenbank's material from Bouvet Island identified as *A. nuda*, belonged to *A. gaussi*.

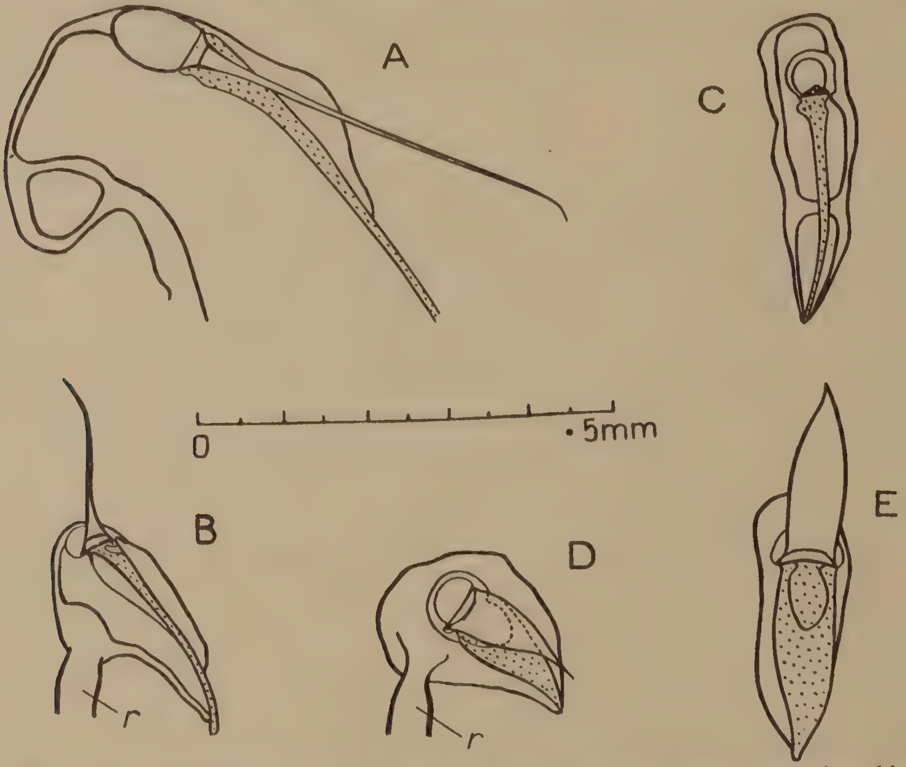

Fig. 2. A–C. *Amastigia benemunita* (Busk). A. From St. WS 85, Falkland Islands. Large lateral basal avicularium with part of proximal limb omitted. B. From St. 399, Gough Island. Smallest kind of lateral basal avicularium (cf. *A. nuda*, fig. D). C. From St. 399. Gough Island. Median basal avicularium at bifurcation. Mandible broken and foreshortened. D, E. *A. nuda* Busk. St. WS 84, Falkland Islands. D. Lateral basal avicularium. E. Median basal avicularium at bifurcation. Grooves into which mandibles fit are stippled. *r*. rootlet.

There is some variation in the size of the frontal avicularia of *A. gaussi*. This is most noticeable in the specimen from St. 167 which has some rather large ones. A fragment from St. 599 has no scuta.

The relationship of *A. gaussi* to *A. nuda* and *A. harmeri* seems to be comparable to the relationship of the Antarctic type of *Caberea darwinii* to the *minima* type and *C. glabra* (see p. 383). It may seem inconsistent to have given them different taxonomic status. My reason is that in *C. darwinii* such characters as the number of spines and the size and length of zooecia intergrade so that no satisfactory line of demarcation is to be found. In *Amastigia gaussi* these relative differences are coupled with a positive character in the presence or absence of the giant spines with constricted base, and it can thus be distinguished with precision from *A. nuda*.

4. **Amastigia benemunita** (Busk). Figs. 2 A–C, 3 A, B.

Menipea benemunita Busk, 1884, p. 19, pl. iv, figs. 4, 4*a*.

Amastigia benemunita Harmer, 1923, pp. 331, 333, 334 (references).

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. 388, 399, 1902, WS 76, WS 79, WS 80, WS 82, WS 84, WS 85, WS 87, WS 88, WS 128, WS 231, WS 237, WS 243, WS 244, WS 245, WS 246, WS 755, WS 765, WS 776, WS 781, WS 836, WS 838, WS 871.

GEOGRAPHICAL DISTRIBUTION. Gough Island (Discovery); Magellanic Region (Jullien; Discovery); Patagonian Shelf (Busk; Hamburg Museum, B. 809, B. 812; U.S. National Museum; Discovery); off Patagonian Shelf down to 339 m. (Discovery; Chile (Busk)).

Harmer noted that two apparently distinct types of basal heterozooecia may be found in *Amastigia benemunita*, resembling those of *A. rudis* and *A. nuda* respectively. The Discovery material has both kinds, but the variation in form and resemblance to avicularia of other species only concern the shape of the avicularian chamber, while the mandible and the beak, or groove, in which it lies are relatively constant, except in size, and differ in shape from those of both *A. rudis* and *A. nuda*.

The avicularian chamber may be more or less L-shaped, with a smaller transverse limb, ending in the rootlet-chamber, and a larger longitudinal limb (Figs. 2 A, 3 A) as in *A. rudis*; or it may be almost oval (Fig. 2 B) as in *A. nuda*; and intermediate states, such as that figured by Levinsen, are found. The proximal limb when present varies in shape and, in narrow branches, where heterozooecia of opposite sides meet, may be considerably distorted (Fig. 3 A). The mandible is apt to be small, or even absent, in these irregularly shaped avicularia. In *A. rudis* (Harmer, 1923, p. 332) the seta is long and slender, and its articulating base has the asymmetrical structure of the true vibraculum as understood by Waters (1913, p. 481). The groove in which it lies is somewhat twisted and its outer border forms a lobe over the articulation. The mandible of *A. nuda* (Fig. 2 D and Harmer, 1923, pl. xvii, fig. 25) is relatively broad with convex sides, and the calcareous parts into which it fits are completely symmetrical and lie in a plane parallel to the surface of the branch. In *A. benemunita* the mandible is setiform with concave lateral borders (Fig. 2 A, B) and lies in a plane slightly oblique to the surface of the branch; but the seta, which is shorter than that of *A. rudis*, is a true mandible with a symmetrical base. The groove is slightly asymmetrical, but there is no lobe. Harmer stated that the single basal heterozooecium in the Challenger specimen (87.12.9.70) of *A. benemunita* resembled those of *A. nuda*, but re-examination in the light of what has been learnt from the Discovery specimens, shows that it is distinguished from those of *A. nuda* by the features just enumerated.

These three species can thus be distinguished by their basal heterozooecia as distinctly as by other characters, and they form an interesting graded series in which *A. nuda* has a true avicularium, *A. benemunita* an avicularium showing some of the characteristics of a vibraculum, and *A. rudis* a true vibraculum.

A median basal heterozooecium is commonly present at the bifurcation in these specimens (Fig. 2 C) and a few are to be seen in the type specimen. Like the lateral basal heterozooecia, which are larger, it has a chamber of variable shape. The mandible is articulated some distance from the distal end of the chamber and is directed straight backwards (i.e. proximally along the branch). The distal prolongation of the chamber is often visible in frontal view as a small triangular cell in the angle of the bifurcation. Marginal avicularia, when present, are most commonly on the zooecia bordering the axil.

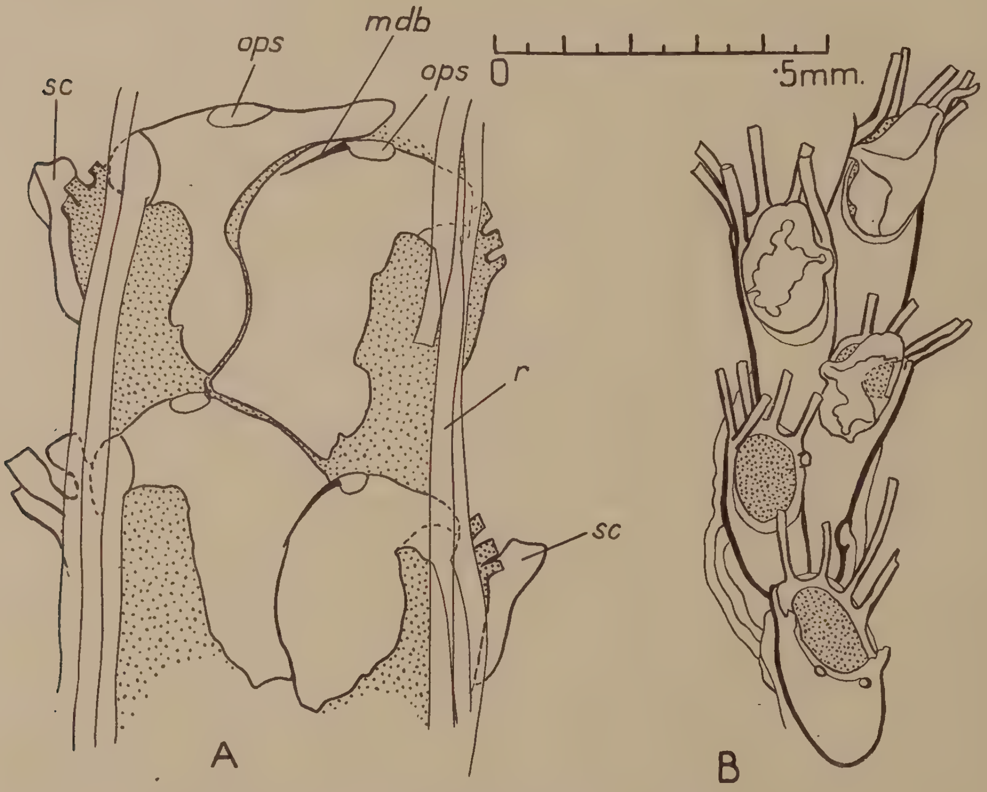

Fig. 3. A. *Amastigia benemunita* (Busk). St. WS 82, Falkland Islands. Basal view of a narrow branch with large basal avicularium. The underlying zooecia are stippled, and the outlines of their basal walls omitted for clarity. Three mandibles are shown, one being open and very short. The fourth heterozooecium has an opesia, but no mandible. B. *A. benemunita* (Busk). Challenger St. 315. Young colony with ancestrula. 34.11.12.47.

mdb. mandible, *ops.* opesia of heterozooecium, *r.* rootlets, *sc.* scutum.

A small colony found among unnamed material from Challenger St. 315 (34.11.12.47) has an ancestrula (Fig. 3 B).

5. **Amastigia kirkpatricki** Harmer.

Caberea kirkpatricki Levinsen, MS.

Amastigia kirkpatricki Harmer, 1923, p. 335, pl. xvii, fig. 20, pl. xix, figs. 46, 48.

Menipea marionensis part Busk, 1884, p. 21, pl. xiv, fig. 9.

STATION DISTRIBUTION. *Sub-Antarctic:* South Indian Ocean, Sts. 1562, 1563, 1564.

GEOGRAPHICAL DISTRIBUTION. Marion Island (Harmer; Discovery); Prince Edward Island (1937.1.2.1; Discovery).

The Discovery specimens agree very closely with the type-material and with Harmer's description.

A few small pieces of *Amastigia* sp. found among unnamed Challenger material from Marion Island (34.2.16.45) agree with *A. kirkpatricki* in the shape of the zooecia and ovicells and in the absence of scuta. The zooecia are a little larger, the internodes longer with a correspondingly longer series of median zooecia, and spines and heterozooecia are completely absent. The position of this form cannot be settled from such scanty material.

6. **Amastigia cabereoides** (Kluge). Fig. 4 D.

Scrupocellaria cabereoides Kluge, 1914, p. 612, pl. xxvii, figs. 3, 4 [not figs. 9, 10, see p. 323 above].

Amastigia caberioides Harmer, 1923, p. 335.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Wilhelm II Land (Kluge); Oates Land (Terra Nova)

The specimens of *Amastigia cabereoides* obtained by the 'Terra Nova' consist of a few small fragments, but agree exactly with Kluge's description, except for the scutum which has a larger proximal lobe (Fig. 4 D). The zooecia of the inner series are partially excluded from the basal surface.

This species is closely allied to *A. kirkpatricki.* It differs in possessing scuta, and in its joints which resemble those of other species of *Amastigia*, while those of *A. kirkpatricki* have the structure found in *Scrupocellaria.*

7. **Amastigia vibraculifera** sp.n. Plate VII, fig. 1; Fig. 4 E.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic, Sts. WS 84, WS 85.

GEOGRAPHICAL DISTRIBUTION. Falkland Islands (Discovery).

HOLOTYPE. St. WS 85.

This species is related to *Amastigia cabereoides* Kluge from which it differs in having more numerous series of smaller (particularly shorter) zooecia, with more numerous, stouter spines and pear-shaped scuta directed obliquely backwards, without distinct proximal and distal lobes (Fig. 4 E). The marginal zooecia usually have one inner spine and four outer ones. The inner zooecia have two or sometimes three spines on one side and one on the other. Most branches have four series of zooecia through most of their

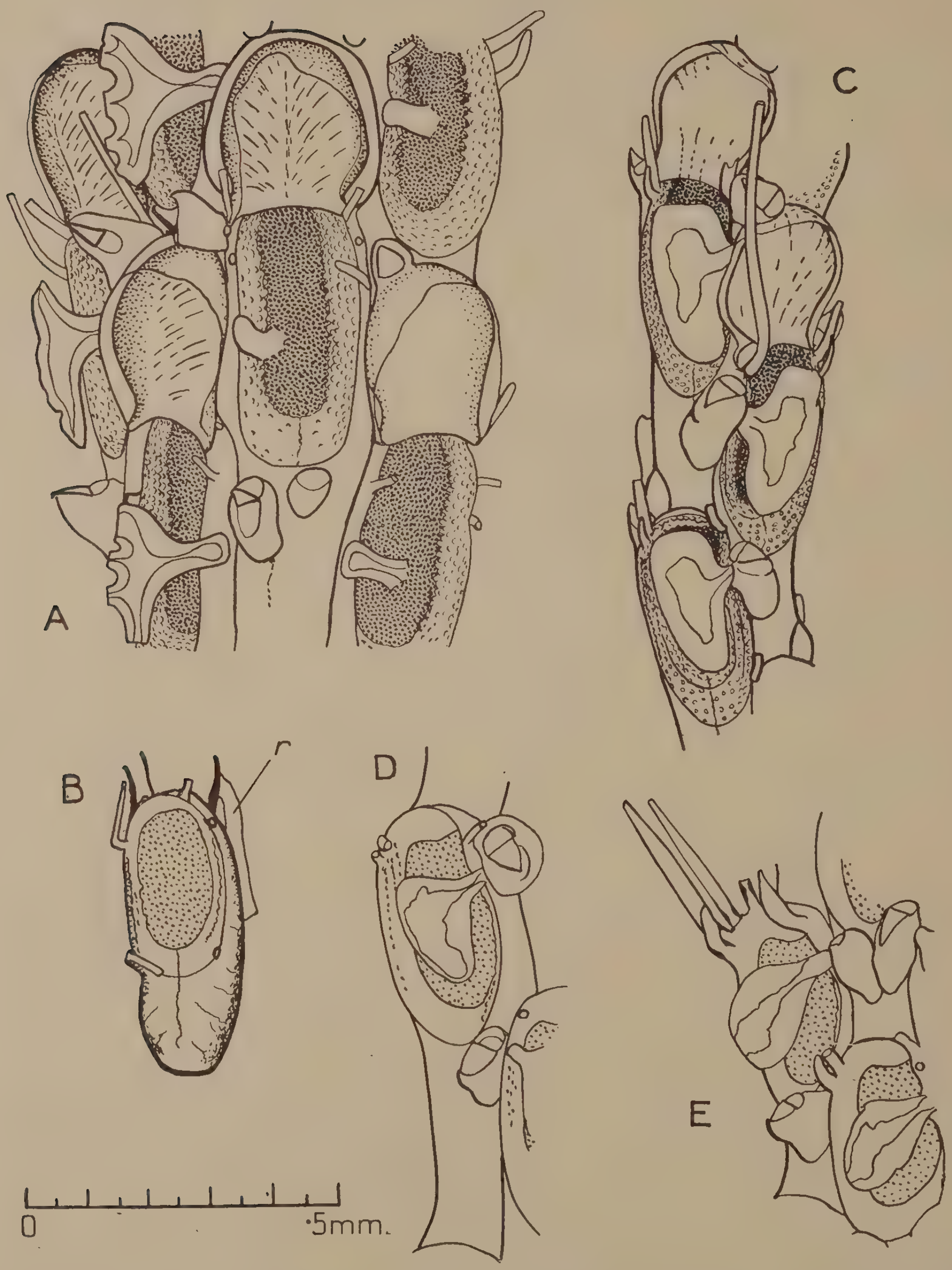

Fig. 4. A, B. *Amastigia solida* (Kluge). St. TN 194, off Oates Land. B. shows an ancestrula in slightly oblique view. C. *A. crassimarginata* (Busk). St. WS 840, between Patagonian Shelf and Burdwood Bank. D. *A. cabereoides* (Kluge). St. TN 194, off Oates Land. E. *A. vibraculifera* sp.n. St WS 85, Falkland Islands. Marginal zooecium and parts of neighbouring zooecia in slightly oblique view.

r. rootlet.

length and some have as many as six. The inner rows of zooecia contribute more to the basal surface than in *A. cabereoides*, and the frontal surface is correspondingly less convex. The branches (Plate VII, fig. 1) thus appear broader and flatter than those of *A. cabereoides*. In other features, including the basal vibracula and the occasional gigantic frontal avicularia, the two species are similar. The ovicells are like those of *A. cabereoides*, as figured by Kluge. The short stout spines, two on the side opposite to the scutum and one on the other, are proximal to the ovicell. The relation of this species to *A. cabereoides* is comparable to that of *A. nuda* to *A. gaussi* (see p. 325).

8. **Amastigia antarctica** (Kluge). Fig. 5 A.

Anderssonia antarctica Kluge, 1914, p. 618, pl. xxxiii, figs. 3, 4.

Amastigia antarctica Harmer, 1923, p. 338.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Wilhelm II Land (Kluge); Oates Land (Terra Nova); Ross Sea (Terra Nova; National Antarctic Expedition).

There are a few fragmentary specimens agreeing very closely with Kluge's description of this species. The basal surface is usually entirely formed by the lateral zooecia, but part of the specimen from the National Antarctic Expedition's winter quarters (no. 10 hole) is 7-serial, and here the median zooecia reach the basal surface forming a broad continuous band. The intermediate series are still completely excluded, or only just visible. In other species of *Amastigia* in which the median and intermediate zooecia are more or less excluded from the basal surface, they take fairly equal shares in the formation of the basal wall, giving a more or less regular lozenge-pattern (e.g. Harmer, 1923, pl. xvii, fig. 24). The ovicells (Fig. 5 A) are rather flatter and straighter sided than those shown by Kluge. The calcified part of the ectooecium forms a narrow band on each side to which the avicularia of the distal zooecium are attached, and the membranous part appears to be continuous with the frontal membrane of the distal zooecium.

As pointed out by Harmer (1923, p. 339), *A. antarctica* is allied to *A. pateriformis* (see below), which is represented in the British Museum by the very small type-colony. In the latter the frontal avicularia, which are unpaired even on the median zooecia, are set very obliquely, or almost transversely, and may be of large, but not gigantic, size. In *A. antarctica* they are paired on the median zooecia and are usually smaller, though the unpaired ones on the lateral zooecia may very much resemble those of *A. pateriformis*. The basal heterozooecium in *A. pateriformis* is placed at the extreme proximal end of the exposed part of the basal wall of the zooecium to which it is attached. In *A. antarctica* the basal wall of the zooecium usually extends a short distance beyond the heterozooecium proximally, as shown by Kluge, and the heterozooecium is smaller, but one specimen (from St. TN 194) has larger, more oblique ones, some of which extend to the proximal end of the exposed part of the basal wall of the zooecium. The median zooecia are not completely excluded from the basal surface of the branch in *A. pateriformis*. It will be seen that none of these differences is absolutely constant, and *A. antarctica* and *A. pateriformis* may, when better material is available, be found to be synonymous.

9. Amastigia pateriformis (Busk).

Menipea pateriformis Busk, 1884, p. 22, pl. v, fig. 4, 4 *a*.
Amastigia pateriformis Harmer, 1923, p. 339.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Off Valparaiso, 3953 m. (Busk).

This species is discussed under *Amastigia antarctica* with which it may be synonymous.

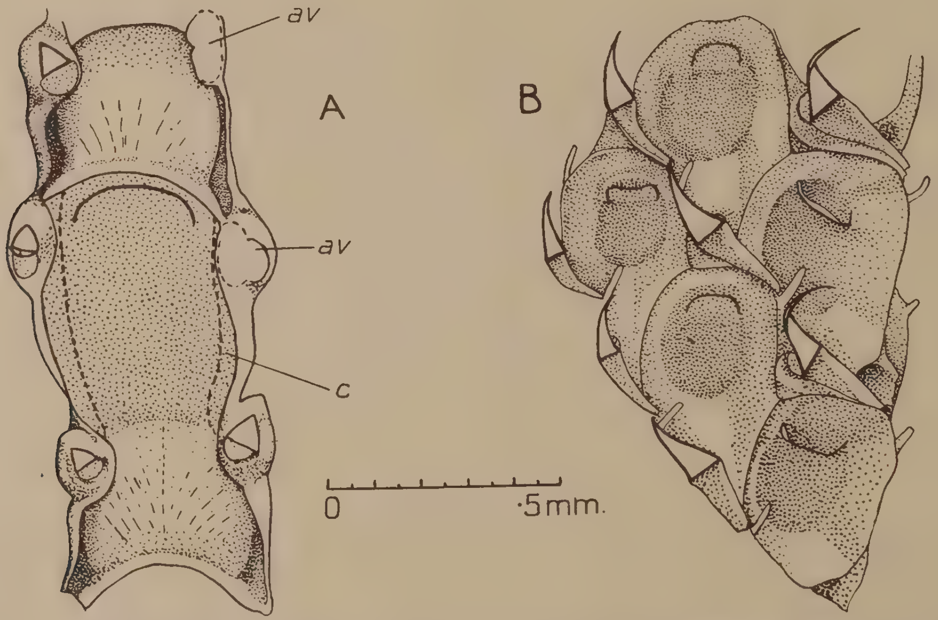

Fig. 5. A. *Amastigia antarctica* (Kluge). National Antarctic Expedition, McMurdo Sound. In the lower ovicell the membranous ectooecium, continuous with the frontal membrane of the distal zooecium, is intact; in the upper it is almost completely destroyed. Edge of cryptocyst indicated by dotted line. B. *Menipea zelandica* sp.n. St. 935, New Zealand.

Both figures drawn from dry specimens seen by reflected light. *av.* avicularium (broken), *c.* cryptocyst.

10. Amastigia solida (Kluge). Fig. 4 A, B.

Scrupocellaria solida Kluge, 1914, p. 611, pl. xxvii, figs. 7, 8.
Amastigia solida Harmer, 1923, p. 338.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Wilhelm II Land (Kluge); Oates Land (Terra Nova).

This species is represented by a few fragments only, but they are quite unmistakable. The spines are attached at the base of the rim of the opesia as shown by Kluge. Ovicells (Fig. 4 A), which were not present on Kluge's material, are to be seen here. The structure in Kluge's fig. 8 which might be mistaken for an ovicell is the projecting rim of the opesia. The ovicells are usually longer than wide, sometimes more nearly spherical. The ectooecium has faint striations, radiating from a median longitudinal line.

A young colony with ancestrula was obtained at St. TN 194, off Oates Land, on 22 February 1911. It was slung by rootlets. The ancestrula (Fig. 4 B) is of the same type as that of *Amastigia benemunita* but is longer and relatively narrower. The oval opesia has a granular cryptocyst and there are six spines, widely spaced round the opesia so that two are distal and two are on each side, one near the distal and the other near the proximal end of the opesia. The ancestrula gives rise to two zooecia.

11. **Amastigia crassimarginata** (Busk). Fig. 4 C.

Caberea crassimarginata Busk, 1884, p. 28, pl. xi, fig. 1.
Canda crassimarginata Waters, 1913, p. 480.
Amastigia crassimarginata Harmer, 1923, p. 334.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, St. WS 840.

GEOGRAPHICAL DISTRIBUTION. Off Patagonian Shelf, below 400 m. (Busk; Discovery).

This specimen (Fig. 4 C) agrees closely with the type except that the proximal lobe of the scutum is broad.

12. **Amastigia abyssicola** (Kluge).

Scrupocellaria abyssicola Kluge, 1914, p. 611.
Amastigia abyssicola Harmer, 1923, p. 335.
Scrupocellaria funiculata Waters, 1904, p. 23, pl. viii, figs. 1 *a*, *b*.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Southern Ocean, 2450 m. (Kluge); Bellingshausen Sea, 2800 m. (Waters).

I have seen no specimen of this species. Its basal heterozooecia are undescribed, and its most characteristic feature appears to be the lobed lumen of the scutum. The cryptocyst is described as wide and granular.

Menipea Lamouroux, 1812

Key to the species

1. Zoarium bi- or triserial 2
Zoarium pluriserial 9

2. Zoarium triserial, at least in part, ovicells present 3
Zoarium biserial except for presence of an axillary zooecium, ovicells rudimentary or absent 4

3. Zoarium mainly biserial, branches keeled frontally, frontal avicularia usually single, cryptocyst with spines ... ... **M. marionensis**[1]
Zoarium mainly triserial, branches flat, frontal avicularia often paired on median zooecia, cryptocyst commonly with a median tooth ... ... 5. **M. triseriata**

4. Opesia occupying whole frontal surface, branch compact straight-sided, spines absent ... 5
Opesia not occupying whole frontal surface, branch neither compact nor straight-sided, spines present 6

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[1] For the species of *Menipea* not discussed in this report see Harmer (1923).

5. Marginal avicularia absent, frontal avicularia present below bifurcation, outer distal corner angular or spike-shaped ... ... **M. ornata**[1]
Marginal avicularia present, frontal avicularia absent, outer distal corner rounded ... ... **6. M. quadrata**

6. Frontal avicularia columnar, branches curled at tip ... ... **1. M. crispa**
Frontal avicularia sessile, branches not curled... 7

7. Frontal avicularia with setiform mandibles ... ... **3. M. flagellifera**
Mandibles of frontal avicularia not setiform 8

8. Ovicells vestigial, cryptocyst granular ... ... **4. M. kempi**
Ovicells absent, cryptocyst smooth ... ... **2. M. patagonica**

9. Colony bilaminar... 10
Colony unilaminar 11

10. Frontal avicularia paired, small, with short mandible, branches straight, wider distally ... ... **M. roborata**[2]
Frontal avicularia single, rather large, with long, pointed mandible, branches somewhat curved laterally, not markedly wider distally ... ... **7. M. zelandica**

11. Basal heterozooecia present at bifurcation and sometimes elsewhere ... **8. M. vectifera**
Basal heterozooecia absent ... ... **M. ligulata, M. multiseriata, and M. spicata**[2]

1. Menipea crispa (Pallas).

Cellularia crispa Pallas, 1766, p. 71.

Cellaria cirrata Ellis and Solander, 1786, p. 29, pl. iv, fig. dD.

Menipea crispa Harmer 1923, p. 340, pl. xvii, fig. 17 (synonymy); Hasenbank, 1932, p. 364.

Menipea cirrata O'Donoghue, 1924, p. 32; Busk, 1884, p. 22; O'Donoghue and de Watteville, 1937, p. 12.

STATION DISTRIBUTION. *South Africa:* Saldanha Bay.

GEOGRAPHICAL DISTRIBUTION. South Africa (Auctt.; Discovery); Madagascar (Marcus).

Busk (1879, p. 194) recorded *Cellularia cirrata* from Kerguelen, but his specimens so labelled (99.7.1.664 and 665) belong to *Menipea patagonica*. The record for New Zealand by Gray (1843, p. 292), based on Sinclair's collection, is also erroneous. Three of Sinclair's specimens in the British Museum are labelled *M. cirrhata* [*sic*] in Gray's writing. They belong to *Catenicella umbonata* (42.12.9.23), *C. hastata* (42.12.9.24), and *Tricellaria monotrypa* (42.12.9.25). In the same registration there is also a specimen from Algoa Bay labelled *Menipea cirrhata*, and this proves to be *M. triseriata*. Gray was evidently uncertain of the identity of *M. cirrata*, and this uncertainty persisted for some years, for Busk (1851, p. 119) mentions a *Catenicella* "which is most probably the *Menipea cirrata* of Lamouroux, or the *Cellaria cirrata* of Ellis and Solander". It was presumably on Gray's authority that Hutton (1873, p. 90), who had not seen specimens (see his explanation of asterisk, p. 1), gave *Menipea cirrata* in his list of New Zealand species.

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[1] *Cellularia infantae* O'Donoghue (1924, p. 30), of which part of the type material is in the British Museum (23.7.26.1), is a synonym of *Menipea ornata* (Busk).

[2] For the species of *Menipea* not discussed in this report see Harmer (1923).

2. Menipea patagonica Busk. Plate V; figs. 1, 2; Fig. 6 A.

Menipea patagonica Busk, 1852*b*, p. 22, pl. xxv, figs. 1–3, pl. xxvi, figs. 1, 2 [not pl. xxiii, fig. 1 = *Tricellaria aculeata*]; Busk, 1879, p. 194; Jullien, 1888, p. 71; Calvet, 1904, p. 5; Harmer, 1923, p. 341; Vallentin, 1924, p. 373.

Scrupocellaria patagonica Kluge, 1914, p. 615, text-fig. 4.

Menipea obtusa Hasenbank, 1932, p. 370, text-fig. 34 A–D.

Cellularia cirrata Busk, 1879, p. 194 (not *Cellaria cirrata* Ellis and Solander).

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. 222, WS 72, WS 84, WS 87. *Antarctic:* Weddell Quadrant, Sts. 145, WS 25, WS 56, MS 65.

GEOGRAPHICAL DISTRIBUTION. Magellanic Region (Jullien; Calvet; Hamburg Museum, B. 830, B. 979, B. 1205; Discovery); Patagonian Shelf (Busk; Vallentin; Hamburg Museum, B. 812; U.S. National Museum; Discovery); Kerguelen (Busk; Kluge); South Georgia (Hamburg Museum, B. 782; Discovery); Bouvet Island (Hasenbank).

This species is not known from New Zealand, and is included erroneously in Hutton's list of New Zealand Polyzoa (1904, p. 294), the locality not being given in the work quoted by Hutton.

Zooecia with more than two spines are rare, but in most colonies there are a few internodes which have two outer distal spines on the second of the six zooecia. The extra spine takes the place of the marginal avicularium.

As noticed by Busk, there is considerable variation in the shape of the zooecia, slender ones predominating in some colonies. Enlarged marginal avicularia may be almost completely absent from these slender colonies. Colonies are also found in which the more proximal zooecia are very large and long, in quite marked contrast to those composing the more distal branches. The colony from St. WS 72 consists of slender feathery branches, the rest of the Discovery specimens being more shrubby (cf. figs. 1, 2, Plate V). The distal internodes may consist of more than the six zooecia supposed to be characteristic of the species. This is seen in several Falkland Island specimens and in some of Busk's specimens from Kerguelen. Such a branch may end in a biserial internode of as many as five pairs of rather short zooecia (St. WS 72, Falkland Islands). Internodes of either kind may be fertile. The embryo develops in an ovisac in a zooecium whose polypide eventually degenerates. In the earliest stage seen (South Georgia, Hamburg Museum, B. 782), the ovary consists of two fairly small eggs, embedded in a small quantity of tissue, lying in the distal part of the zooecium. One of them increases in size while the other remains almost unchanged and a follicle is formed about them both. Later stages can be seen in another specimen from South Georgia (September 1892, Hamburg Museum, B. 979). The embryos are in advanced stages of segmentation and some are beginning to assume the larval form, the epithelium of the sucker and, where the larva is in a suitable position, the groove of the pyriform organ being visible. The ovisacs are conspicuous, and some are empty. Some polypides are present, but the majority of the zooecia contain brown bodies. Some of the zooecia with an embryo or an empty ovisac also contain one or two small eggs, or one rather larger egg in a follicle, occupying the proximal part of the body cavity. The material taken at St. 145 in January 1927 is at a more advanced stage. Segmentation stages are absent, and polypides are exceedingly rare, while empty ovisacs and embryos showing larval structure are present in considerable numbers.

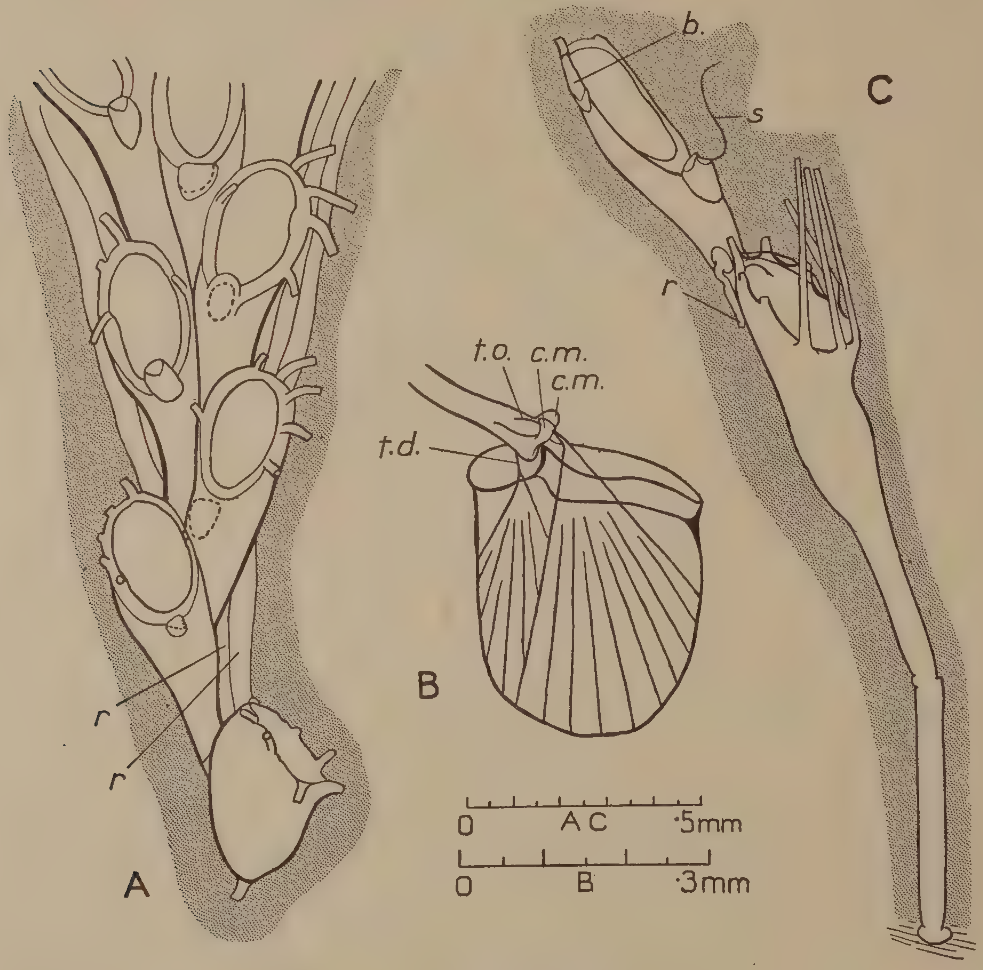

Fig. 6. A. *Menipea patagonica* Busk. 99.7.1.715 (Eaton Collection), Kerguelen. Young colony with ancestrula, drawn from a dry specimen seen by reflected light. B. *M. flagellifera* Busk. St. WS 84, Falkland Islands. To show musculature of frontal avicularium. C. *M. flagellifera* Busk. St. 1563, Marion Island. Ancestrula and first zooecium.

b. bud, *c.m.* condyles of mandible, *r.* rootlet, *s.* seta, *t.d.* tendon of divaricator muscle, *t.o.* tendon of occlusor muscle.

Busk (1879, p. 194) recorded specimens of this species as *Cellularia cirrata* (see p. 332). Hasenbank's description and figure of *Menipea obtusa* agree so exactly with *M. patagonica*, of which I have examined the type material, that there can be no doubt that they are synonymous.

Busk's figure (1852*b*, pl. xxiii, fig. 1), purporting to represent the ancestrula and first few zooecia of this species, was drawn from a specimen of *Tricellaria aculeata* (see

p. 358). A specimen of *Menipea patagonica* from Swain's Bay, Kerguelen (Busk Collection, 99.7.1.715) does, however, show the ancestrula (Fig. 6 A). It is taller than that of *Tricellaria aculeata* and attached by its tubular tip. The first internode is separated from it by a joint, and consists of seven zooecia, of which the first two have five spines arranged along the outer and distal borders of the rather short opesia and one on the inner border. The other five zooecia have successively fewer spines and a longer opesia. The succeeding internodes are typical. In two colonies from the Falkland Islands lent by the U.S. National Museum the first few zooecia are similar to those just described, but the assumption of typical characters is more gradual, so that several internodes consist of rather shorter zooecia with more than the usual number of spines. The ancestrula has broken away in both.

3. **Menipea flagellifera** Busk. Figs. 6 B, C, 7 C.

Menipea flagellifera Busk, 1884, p. 21, pl. iv, fig. 1; Calvet, 1904, p. 6; Harmer, 1923, p. 343.

Scrupocellaria flagellifera Kluge, 1914, p. 615, text-fig. 5.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. WS 79, WS 81, WS 82, WS 84, WS 85, WS 87, WS 88, WS 220, WS 225, WS 228, WS 231, WS 237, WS 239, WS 243, WS 244, WS 245, WS 246, WS 824, WS 838, WS 871; South Indian Ocean, Sts. 1562, 1563, 1564.

GEOGRAPHICAL DISTRIBUTION. Patagonian Shelf (Busk; Calvet; Discovery); off Patagonian Shelf, down to 339 m. (Discovery); Marion Island (Busk; Discovery); Prince Edward Island (Discovery); Kerguelen (Busk; Kluge).

The setiform mandible of the frontal avicularium has a thickened base, which would be more or less triangular in cross-section, and has its corners drawn out to form massive condyles (Fig. 6 B). The divaricator and occlusor muscles appear to be unpaired and are attached to opposite surfaces of the mandible, medianly and at a little distance from its base, the tendon of the occlusor muscle passing between the condyles. The setiform mandible with its massive condyles gives this heterozooecium a strong superficial resemblance to a vibraculum, but it appears to be almost symmetrical in structure (the condyles differ a little in shape), and to have only a symmetrical two-way movement of the mandible, and is therefore, as Harmer also concluded, an avicularium.

Fertile zooecia are to be seen in material collected at St. 1564 (Prince Edward Island, 7 April 1935), but are not numerous. The embryo occupies a large sac in the body-cavity and the ovicell is represented by a small cap at the distal end of the zooecium, the cryptocyst being interrupted at this point (Fig. 7 C).

There are ancestrulae of this species from Sts. 1563 and 1564 (Marion and Prince Edward Islands, 7 April 1935). The ancestrula is of the "vase-shaped" type with oblique distal opesia surrounded by spines. It is chiefly remarkable for the length of its stalk-like proximal part (Fig. 6C). The suggestion of a joint in this part in the figured specimen is due to an accidental kink. The ancestrula is attached by a small disk. The characteristic frontal vibraculum is present on the first zooecium budded from the ancestrula.

4. **Menipea kempi** sp.n. Fig. 7 A, B.

STATION DISTRIBUTION. *Sub-Antarctic:* South Indian Ocean, Sts. 1562, 1563.

GEOGRAPHICAL DISTRIBUTION. Marion Island (Discovery).

HOLOTYPE. St. 1562.

DESCRIPTION. *Zoarium* biserial with bifurcation of Harmer's type 17 (Fig. 7 A).

Zooecia with oval opesia occupying not more than half total length, with narrow tuberculate cryptocyst of uniform width except at distal end where it is narrower.

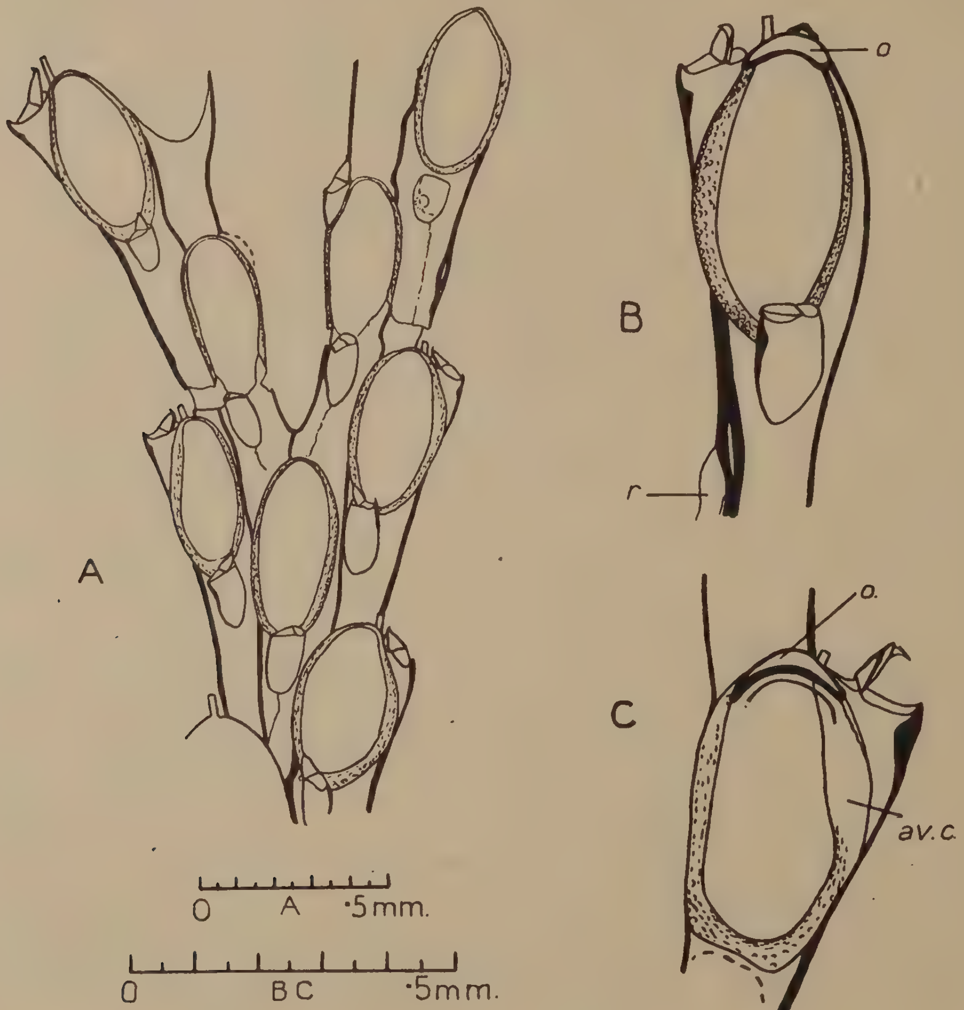

Fig. 7. A, B. *Menipea kempi* sp.n. St. 1562. Marion Island. A. Bifurcation. B. Fertile zooecium. The little thick-walled chamber above the ovicell is not constantly present. C. *M. flagellifera* Busk. St. 1564. Prince Edward Island. Fertile zooecium. The position of the frontal avicularium is indicated with a dotted line. *av.c.* chamber of marginal avicularium, *o.* ovicell, *r.* rootlet.

Spines: one very small spine on basal surface of outer distal corner, between marginal avicularium and distal zooecium, as in *Menipea flagellifera*.

Avicularia: frontal and marginal, constantly present, with well-developed beak.

Ovicells (Fig. 7 B), cap-like, embryo developing in large ovisac in body cavity.

REMARKS. This species is most nearly related to *M. flagellifera*, which it resembles in the general form of its colony and zooecia, in its granular cryptocyst and in its cap-like ovicells. It differs in its frontal avicularia which have a short triangular mandible. The avicularian chamber of *M. kempi* is not unlike that of *M. flagellifera* in outline, but it projects more, having a raised and prominent beak. The differences between the flagelliform mandible of the one species, with its basal condyles, and the small triangular mandible of the other, are constant and very pronounced. The marginal avicularia of *M. kempi* are somewhat turned towards the frontal surface.

M. kempi also resembles *M. patagonica*. It differs chiefly in the possession of ovicells, however small, *M. patagonica* having similar embryo sacs but no trace whatever of ovicells. *M. kempi* also differs from *M. patagonica* in its granular cryptocyst; in its shorter opesia; in its frontal avicularia which are larger with a more strongly developed beak; in the greater variability in the number of zooecia composing the internodes, and the greater distance of the joints from the axil; and in the very small size of the outer distal spine and the absence of the inner one. The marginal avicularia of *M. patagonica* tend to have their beak turned obliquely towards the frontal surface, but in *M. kempi* this position is more marked and the avicularia are less variable in size.

5. **Menipea triseriata** Busk.

Menipea triseriata Busk, 1852*b*, p. 22, pl. xxiii, figs. 2–4; Hasenbank, 1932, p. 367, text-fig. xxxii A–F (references).

Cellularia triseriata O'Donoghue, 1924, p. 31; O'Donoghue and de Watteville, 1937, p. 13.

STATION DISTRIBUTION. *South Africa:* Saldanha Bay.

GEOGRAPHICAL DISTRIBUTION. South Africa (Auctt.; Discovery).

6. **Menipea quadrata** (Busk).

Cellularia quadrata Busk, 1884, p. 18, pl. v, figs. 5–5*b*.

Menipea quadrata Harmer, 1923, p. 342.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Kerguelen; Heard Island (Busk).

7. **Menipea zelandica** sp.n. Plate V, figs. 3, 5; Figs. 5 B, 8 A.

STATION DISTRIBUTION. *New Zealand:* Sts. 933, 935.

GEOGRAPHICAL DISTRIBUTION. New Zealand (Discovery).

HOLOTYPE. St. 935.

DESCRIPTION. *Colony* dichotomous, bilaminar, slung by rootlets, unjointed, except that some branches are cracked at their base and remain connected by rootlets (Plate V, fig. 3).

Branches flattened, twelve series of zooecia maximum observed.

Rootlets originating from marginal zooecia, emerging on frontal surface and running down edges of branches, forming bundles.

Zooecia with a single marginal spine on one or both sides at some distance from distal end (Fig. 5 B). Opesia oval, cryptocyst wide, steeply descending, granular, gymnocyst almost covered by single frontal avicularium. Oral shelf broad (Plate V, fig. 5). Basal wall more or less narrow, absent in one or two marginal rows (Fig. 8 A) where zooecia are triangular in transverse section. Marginal zooecia drawn out laterally, zooecia of inner series symmetrical.

Frontal avicularia (Fig. 5 B) graded in size from the margins to the centre of the branch, largest on marginal zooecia, all directed obliquely proximally and towards the nearest edge of the branch, beak slightly raised, curved or straight, mandible rather long and sharply pointed.

Ovicells unknown.

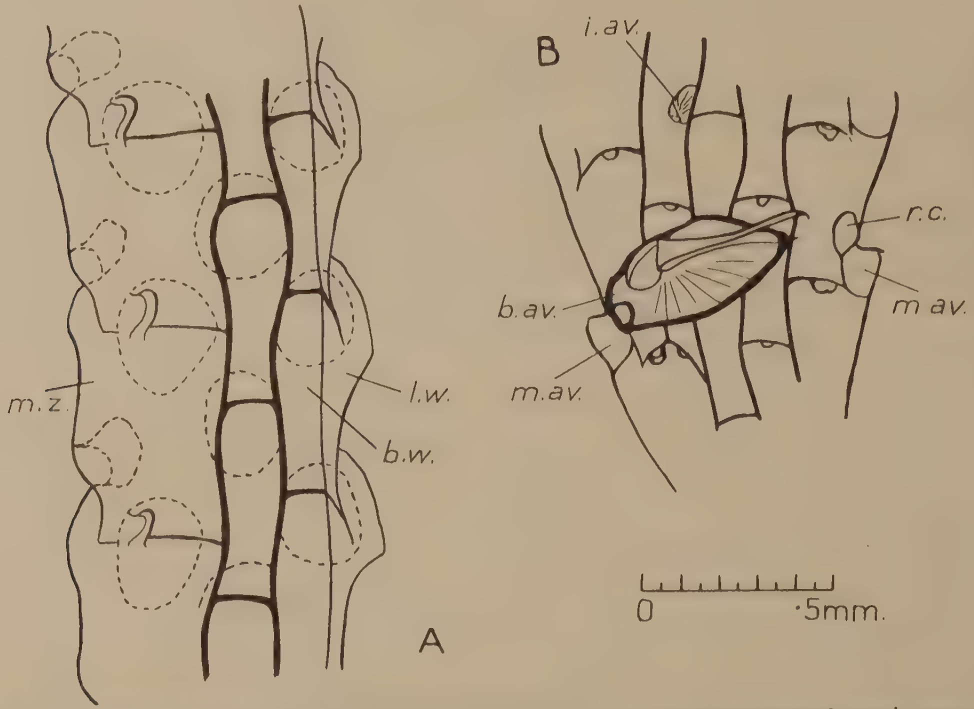

Fig. 8. A. *Menipea zelandica* sp.n. St. 935, New Zealand. The three marginal series of zooecia, separated from the rest by eau de javelle, in basal view. Opesiae and rootlet-chambers shown with dotted line. B. *M. vectifera* Harmer. St. 929, New Zealand. Large basal avicularium at intercalation of new series of zooecia with underlying zooecia outlined.

b.av. basal avicularium, *b.w.* basal wall of zooecium of inner series, *i.av.* internal avicularium, *l.w.* lateral wall of inner series, *m.av.* marginal avicularium, *m.z.* marginal zooecium, *r.c.* rootlet-chamber.

REMARKS. This species resembles *Menipea roborata* (Hincks), which is also bilaminate, in the shape of the zooecia and of their cryptocyst and oral shelf, in the spines, and the rootlets. The frontal avicularia are unpaired and larger; the rootlet chambers are larger and the zooecia are distinctly larger. The branches show less terminal widening and are frequently curved, cf. the straight or concave margins of the branches of *M. roborata* in Plate V, fig. 4 and the curved branches with one margin convex and the other concave to the right of the colony of *M. zelandica*, Plate V, fig. 3.

The frontal origin of the rootlet in this species and *M. roborata* is doubtless correlated with the absence of any exposure of the lateral and basal walls in a bilaminar colony. It is rather more pronounced in *M. zelandica* than in *M. roborata*.

8. **Menipea vectifera** Harmer. Fig. 8 B.

Menipea vectifera Harmer, 1923, p. 346, pl. xvii, fig. 23, pl. xviii, figs. 36–39.

STATION DISTRIBUTION. *New Zealand:* Sts. 929, 935.

GEOGRAPHICAL DISTRIBUTION. New Zealand (Harmer; Discovery); Palliser Bay, Wairarapa, New Zealand (90.5.27.95).

This material agrees very exactly with Harmer's description and the British Museum specimens, except that in addition to the basal avicularia at the bifurcation there are others of similar shape but much greater size on other parts of the basal surface (Fig. 8 B). These large avicularia are placed transversely and may extend across as many as five series of zooecia. The figured example is not one of the largest. It seems that both kinds of basal avicularia are associated with the formation by one zooecium of a pair of distal buds. Where one of the inner series is duplicated in this way it invariably, as far as my observations go, leads to a bifurcation and not to increase in the number of series in the branch. The axillary avicularium appears to originate on the common lateral wall of the two daughter zooecia and overlies parts of the basal surface of both. The number of series in a branch seems to be increased solely by the marginal zooecia, the inner of a pair of distal buds forming an additional inner series of symmetrical zooecia, the outer bud continuing the marginal series of asymmetrical zooecia. It is at these points that the large basal avicularia are found, originating from the outer of the two daughter zooecia and overlying the inner of the two, and two or three more inner series. Basal avicularia have not been found except in association with paired buds, but such duplications do occur without formation of avicularia.

Notoplites Harmer, 1923

The definition of *Notoplites* Harmer (1923, p. 348) must be modified to admit uniserial colonies with lateral branches (see *N. tenuis* var. *uniserialis*, p. 351).

There are eight species and one variety of *Notoplites* in these collections, falling into two groups of closely related forms: the *N. antarcticus* group, comprising *N. antarcticus*, *N. watersi*, *N. drygalskii* and *N. vanhöffeni*; and the *N. elongatus* group, comprising *N. elongatus*, *N. tenuis*, *N. klugei* and *N. crassiscutus*.

The four species of the *N. antarcticus* group all possess the internal spines noticed by Waters in *N. antarcticus*. One projects from the proximal wall in most zooecia, and its tip is divided into two or three points which may be curved and hooked (see *N. drygalskii*, Fig. 9 A). It is sometimes hidden in frontal view by the overlapping of the proximal zooecium and the corresponding obliquity of the wall from which the spine springs. *N. perditus* may belong to this group, see p. 355.

In three of the four species of the *N. elongatus* group (*N. elongatus*, *N. tenuis* and *N. crassiscutus*) there may be an oval, apparently thinner, area in the outer lateral wall of the zooecium, sometimes with a linear series of smaller similar areas proximal to it (Figs. 14 A–C, 16 B). They can be seen to be the points of attachment of the opercular and parietal muscles, but they are not apparent in young zooecia, presumably owing to the less advanced calcification. They are more conspicuous, when present, in *N. tenuis* than in the other two species. They have not been seen in *N. klugei*, but the specimen is not in very satisfactory condition for seeing them. Nor have they been seen in the species of the *N. antarcticus* group, that part of the wall being covered by the marginal avicularium. They are not peculiar to species of *Notoplites*. They are present, for example, in *Camptoplites areolatus* (Kluge) and *Amastigia kirkpatricki* Harmer, and Busk figured them (1852 *b*, pl. xxvii, fig. 4) in *Tricellaria peachii*.

The ancestrulae are known in only four of the species, two from each group, but it is perhaps worth noticing that the two from the *elongatus* group are short (slipper-shaped) and give rise to a single zooecium, the branch becoming biserial subsequently, but that in the two from the *antarcticus* group the ancestrula is tall (vase-shaped) and gives rise to a pair of zooecia (cf. Figs. 13 A, C and 11 A, B). On the other hand, ancestrulae resembling those of *N. elongatus* and *N. tenuis* are found in species belonging to other genera of the Scrupocellariidae, e.g. in *Tricellaria aculeata* (see p. 358).

Key to the species of Notoplites *in the collection*

1. Colony biserial ... 2
   Colony uniserial ... 8. **N. tenuis var. uniserialis var.n.**
2. Internal spines present, marginal avicularia conspicuous, ectooecium with small uncalcified area[1] ... 3
   Internal spines absent, marginal avicularia relatively small, or absent, ectooecium largely uncalcified ... 6
3. Frontal avicularium inclined towards neighbouring zooecium ... 4
   Frontal avicularium inclined away from neighbouring zooecium ... 5
4. Scutum covering opesia (with rare exceptions), not S-shaped, its proximal lobe broad, branches stout ... 3. **N. drygalskii**
   Scutum not covering opesia, more or less S-shaped, both lobes narrow, branches slender ... 1. **N. antarcticus**
5. Distal border of scutum oblique, operculum set obliquely, branches slender 2. **N. watersi**
   Distal border of scutum transverse, operculum set transversely, branches stout 4. **N. vanhöffeni**
6. Scuta, spines and marginal avicularia absent, joints incomplete or absent ... 9. **N. klugei**
   Spines and scuta present on at least some zooecia, marginal avicularia present or absent, joints constantly fully developed ... 7
7. Scutum covering opesia, with indented or reduced lumen, basal or marginal avicularia, or both, present ... 8
   Scutum not covering opesia, lumen extensive and not indented, basal and marginal avicularia absent ... 7. **N. tenuis**
8. Small marginal avicularia present, scutum not thickened, its lumen variously indented, cryptocyst smooth, basal avicularia in axil when present, curved ... 9
   Marginal avicularia absent, scutum thickened and radially striated, its lumen reduced, cryptocyst granular, basal avicularia proximal to axil, flat 10. **N. crassiscutus**

[1] *N. perditus*, which I have not seen, may come into this group.

9. Basal avicularia absent, distal border of aperture of fertile zooecium smooth 5. **N. elongatus**
Axillary basal avicularia present, distal border of aperture of fertile zooecium beaded
6. **N. elongatus var. calveti**

1. **Notoplites antarcticus** (Waters). Figs. 9 D, 10 C, 11 B.

Scrupocellaria antarctica (part) Waters, 1904, p. 25, pl. i, fig. 5 *a–e*.

Scrupocellaria antarctica Kluge, 1914, p. 606, pl. xxviii, fig. 1.

Notoplites antarcticus Harmer, 1923, p. 352.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, Sts. 39, 42, 148, 158, 160, 181, 187, 1948, WS 42.

GEOGRAPHICAL DISTRIBUTION. South Georgia (Shackleton-Rowett Expedition; Discovery); Shag Rocks; near Elephant Island; Palmer Archipelago (Discovery); Bellingshausen Sea (Waters); Wilhelm II Land (Kluge); Oates Land (Terra Nova).

Kluge shows smooth ovicells in *Notoplites antarcticus*, but in these specimens, which otherwise agree very closely with his restricted definition, the ovicells are sculptured as in Waters's figure. The sculpture is chiefly peripheral, and particularly lateral, and consists of papillae on the outer surface of the entooecium, and less numerous lumps and projections on the inner surface of the ectooecium, some of the projections from the two surfaces being opposite and meeting tip to tip (Fig. 10 C). There are also small thin patches in the ectooecium. The "gefelderte" sculpture of the ovicell of *N. watersi* consists of larger and more numerous, but otherwise similar, thin areas in the ectooecium, internal sculpture being only very slightly developed. The ovicell of *N. antarcticus* is shorter and more prominent than that of *N. watersi*. Internal spines are developed in the zooecia (see p. 339).

The scutum is rather variable within the colony, and, despite Kluge's statement that the proximal lobe is rounded, may be quite pointed in otherwise typical specimens. In part of the material from St. 1948 the proximal lobe is pointed and strongly curved, its tip overlapping the inner lateral edge of the opesia (Fig. 9 D). In these specimens some of the frontal avicularia are small and directed frontally as in the figure; others are typical. Zooecia with two distal spines are also not uncommon in this material, sometimes on zooecia with no marginal avicularium, as noticed by Kluge, but also on zooecia that have the avicularium.

Five ancestrulae, believed to belong to this species, have been found in the Discovery collection, from St. WS 42, 7 January 1927; St. 1948, 4 January 1937; St. 187, 18 March 1927. They are erect and vase-shaped (Fig. 11 B); the attachment is almost tubular; the opesia is distal and oblique; two zooecia are budded from the distal end of the ancestrula and no joint is formed. The first zooecium has a scutum, a small marginal avicularium and two or three spines, and sometimes a small frontal avicularium, directed frontally. Where unbroken the scutum of the first zooecium has the form characteristic of the species. The rest of the zooecia successively approach more nearly to the typical specific form, but the larger frontal avicularia, leaning towards the neighbouring zooecium, evidently do not appear till a fairly late stage. The largest of these young colonies has eight zooecia, and the frontal avicularia are all small and directed frontally.

2. **Notoplites watersi** (Kluge).

Scrupocellaria watersi Kluge, 1914, p. 607, pl. xxviii, fig. 2.
Scrupocellaria antarctica (part) Waters, 1904, p. 25.
Notoplites watersi Harmer, 1923, p. 353.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Bellingshausen Sea (Waters); Wilhelm II Land (Kluge); Oates Land (Terra Nova); Ross Sea (National Antarctic Expedition).

The bifurcation of *Notoplites watersi* is of the normal type for the genus, as suspected by Harmer. Internal spines are present (see p. 339).

The angular outline of the branches of *N. antarcticus* and the straighter appearance of those of *N. watersi*, which are shown in Kluge's figures, but not mentioned in his comparison, are sufficiently marked to make it possible to sort a mixture of the two species without magnification. The relation of this species to *N. antarcticus* resembles in some ways that of *N. vanhöffeni* to *N. drygalskii*, as may be seen from the key, and in each pair one species is widely distributed in the Antarctic region including South Georgia, and the other has been found much less abundantly and only in the far south (see p. 479), where, however, all four species may be found together (e.g. at St. TN 194 off Oates Land).

3. **Notoplites drygalskii** (Kluge). Plate VI, fig. 6; Figs. 9 A–C, 11 A.

Scrupocellaria drygalskii Kluge, 1914, p. 609, pl. xxvii, fig. 5.
Notoplites drygalskii Harmer, 1923, p. 352; Livingstone, 1928, p. 25 (synonymy).
Menipea funiculata Thornely, 1924, p. 6.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, Sts. 27, 42, 123, 140, 144, 148, 152, 175, 177, 181, 187, 363, 366, 371, 1872, WS 25, WS 27, WS 33; Victoria Quadrant, Sts. 1652, 1658, 1660.

GEOGRAPHICAL DISTRIBUTION. South Georgia; South Sandwich Islands; near Elephant Island; South Shetland Islands; Palmer Archipelago (Discovery); Adelie Land; Queen Mary Land (Livingstone); Wilhelm II Land (Kluge); Oates Land (Terra Nova); Ross Sea (National Antarctic Expedition; Terra Nova; Discovery).

As mentioned above *Notoplites drygalskii* and *N. vanhöffeni* are related, but clearly distinct, species. In *N. vanhöffeni* the aperture is narrowed behind the orifice by a projection of the border on each side (Figs. 10 A, B); the scutum has a straight transverse distal border and the operculum is placed symmetrically in the frame so formed. In *N. drygalskii* the aperture is not contracted, the outer border bearing little or no projection, the operculum is obliquely placed and the edge of the scutum is correspondingly oblique (Fig. 9 A), but the operculum is not so closely framed. The obliquity is especially pronounced in non-fertile zooecia (Figs. 9 A, B). The difference in inclination of the frontal avicularia is constant. The marginal avicularium is more distally placed in *N. drygalskii* (cf. Figs. 9 A–C, 10 A, B, and Kluge's pl. xxvii, figs. 5, 6). The ovicells in *N. drygalskii* are immersed in the distal zooecium (Fig. 9 B). Those of

N. vanhöffeni, though they are probably equivalent in their morphology, project more from the branch both frontally and laterally, being larger and more rounded (Fig. 10A). This gives a distinctly different appearance to the fertile branches of the two species, but the non-fertile branches also differ so distinctly that a mixture of the species can be

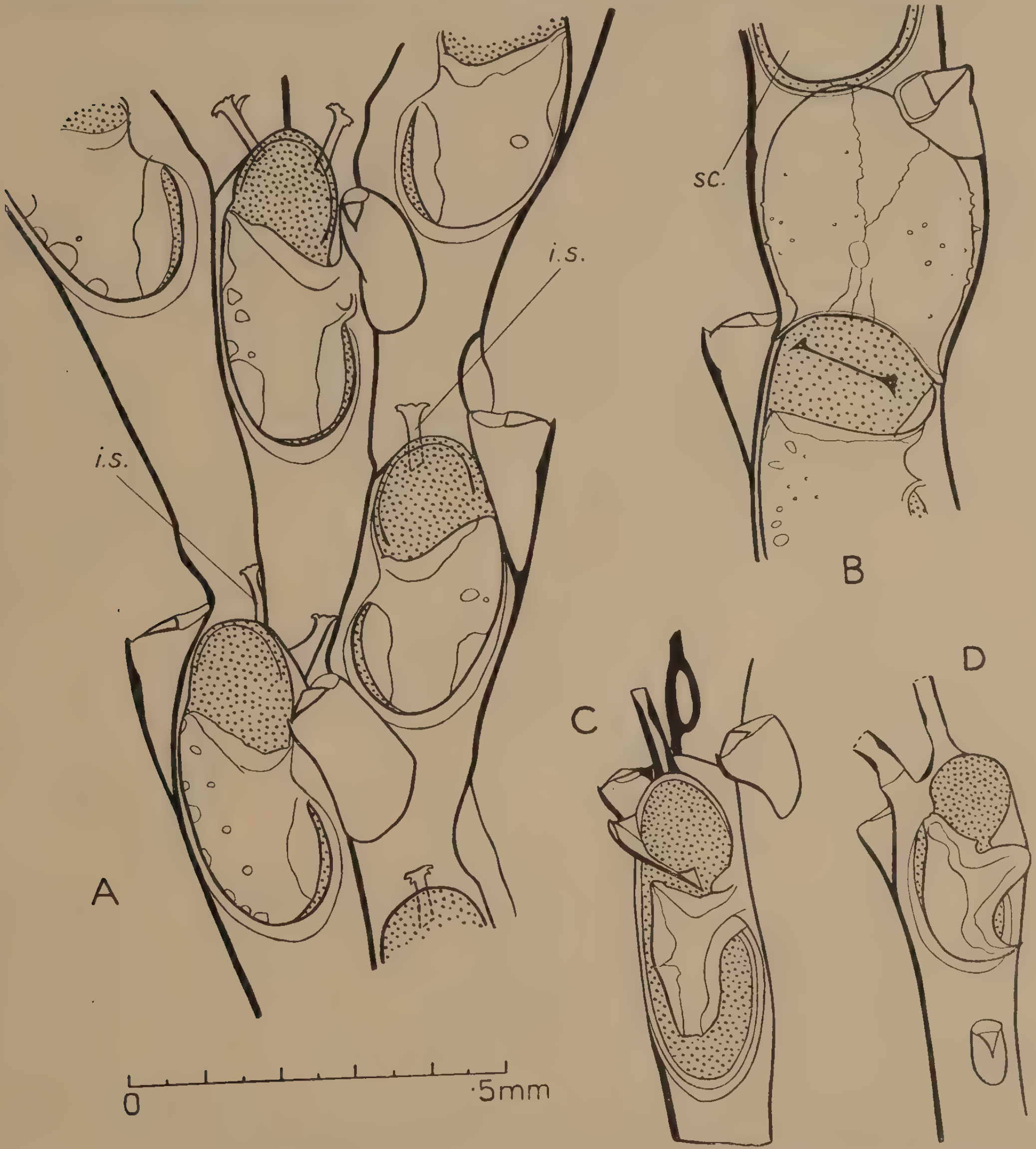

Fig. 9. A. *Notoplites drygalskii* (Kluge). St. WS 27, South Georgia. To show internal spines (attached to oblique distal wall) and differences in orifice from *N. vanhöffeni* (cf. Fig. 10 B). In some specimens the distal wall is farther from orifice. B. *N. drygalskii* (Kluge). St. TN 331, Ross Sea. Ovicell and adjacent structures. The operculum is open. C. *N. ?drygalskii* (Kluge). St. TN 194, off Oates Land. One zooecium showing abnormal scutum. Slightly oblique view. Operculum open. D. *N. antarcticus* (Waters). St. 1948, near Elephant Island. One zooecium.

i.s. internal spine, *sc.* scutum.

sorted without magnification. *N. vanhöffeni* has stouter branches with a more serrated outline due to the difference in shape of the majority of the marginal avicularia (cf. Figs. 9 A–C and 10 A, B). These not only differ in outline but have their mandibular surface tilted more towards the frontal surface of the branch. All this is shown in Kluge's figures.

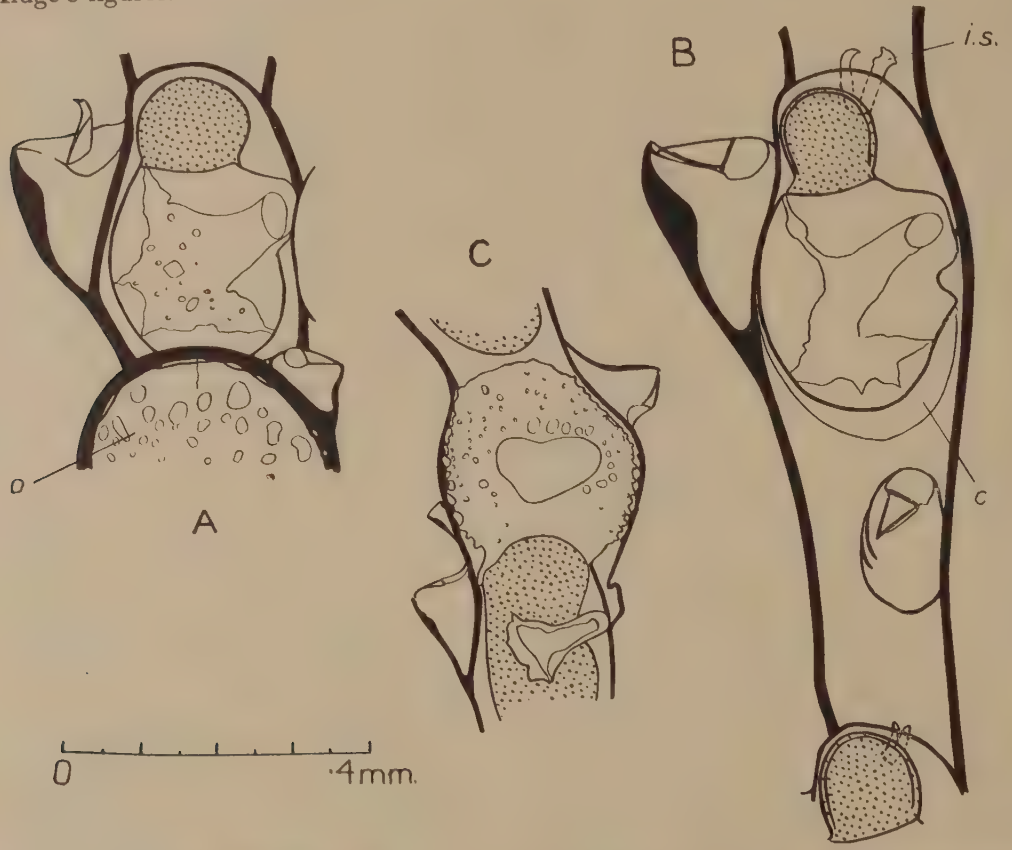

Fig. 10. A. *Notoplites vanhöffeni* (Kluge). St. TN 348, McMurdo Sound. One zooecium to show scutum with 'islands'. Part of the ovicell of the proximal zooecium is also shown. B. *N. vanhöffeni* (Kluge). St. TN 339, Ross Sea. To show branched internal spines and differences in orifice from *N. drygalskii* (cf. Fig. 9 A). C. *N. antarcticus* (Waters). St. 39, South Georgia. Ovicell and adjacent structures. The scutum is not normal, cf. normal scutum shown in Fig. 9 D.

c. cryptocyst, *i.s.* internal spine, *o.* ovicell.

The ovicells of *N. vanhöffeni* are always sculptured, those of *N. drygalskii* are usually smooth, but occasionally (e.g. from St. TN 331) there are little papillae on the entooecium giving the ovicell a sparsely punctate appearance (Fig. 9 B).

The frontal avicularia vary in size, and there is some variation in the pattern of the scutum. In *N. drygalskii* there may be "granulation" as in Kluge's specimens or these markings may be larger and more irregular as in the specimen figured (Fig. 9 A). In either case they appear to be interruptions, "islands" one might call them, in the lumen, not granulations of the surface of the scutum. In *N. vanhöffeni* the lumen is less extensive and more or less branched (Fig. 10 B), as in Kluge's figure, and "islands" are only very exceptionally present (Fig. 10 A).

The zooecia of *N. drygalskii* may be longer than shown by Kluge, with a corresponding elongation of the opesia. In such specimens the distal spine is commonly absent, and when present is small. In all these characters there is considerable variation within the colony.

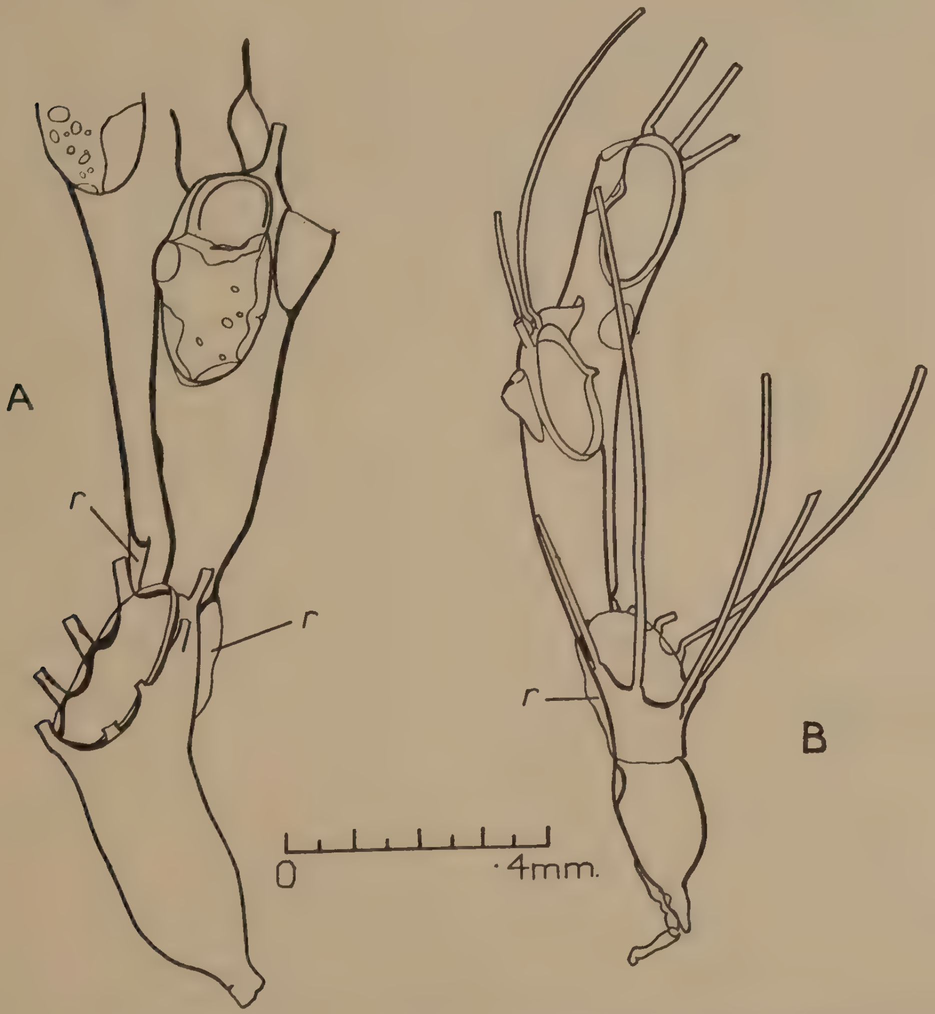

Fig. 11. A. *Notoplites drygalskii* (Kluge). National Antarctic Expedition. McMurdo Sound. Showing ancestrula. B. *N. antarcticus* (Waters). St. WS 42, South Georgia. Showing ancestrula. *r*. rootlet.

Certain specimens in the Terra Nova collection differ from typical *N. drygalskii* in their scuta. Both distal and proximal lobes are shorter and narrower, and the lumen is narrow and more or less bifid, and has no "islands" (Fig. 9 C). In typical specimens the scuta cover the opesia, except for the area occupied by the operculum, and their oblique distal border closely follows the hinge line of the opercular valve. Most of the aberrant scuta are worn and chipped, but the differences in the lumen are such that they could not be derived from normal ones merely by wear. The difference is definite, and there appear to be no intermediate specimens, but as no other distinction has been noticed and the variability of scuta is well known, I have not separated these specimens from *N. drygalskii*. In the material from St. TN 194 the two forms are present in almost equal quantities, and St. TN 339 also yielded both. From St. TN 316 only the aberrant type was obtained.

N. drygalskii seems to be much more common than *N. vanhöffeni* in the regions in the far south visited by the 'Discovery', as well as being found at South Georgia where *N. vanhöffeni* has not been recorded. At St. 1652 (Ross Sea) the 'Discovery' obtained fifteen luxuriant colonies of *N. drygalskii*. The largest was 16 cm. long and 11 cm. across at its thickest point (Pl. VI, fig. 6), and several of the others were only a little smaller. In each colony the rootlet bundles form quite a stout stalk, ending in a tuft of rootlets to which little black stones and grit adhere.

N. vanhöffeni is only represented from a few stations and the material is sparse and rather fragmentary. In this species also the rootlets form a stalk, but no complete colony showing the attachment has been seen.

Testes of the usual type are to be seen, consisting of very numerous clusters of cells filling the proximal part of the body-cavity. Ova of moderate size are sometimes present in the same zooecia as the spermatic tissue. In the material from St. 371 (14 March 1930) many zooecia have the ovicell empty and a large egg in the body-cavity, while in others the egg has passed into the ovicell and, in some, has begun to segment. The specimen obtained by the National Antarctic Expedition in McMurdo Sound on 13 February 1902 had three ancestrulae of the same species attached to it. They are vase-shaped and have eight or nine spines and are attached by a tubular prolongation of the proximal end (Fig. 11 A). Succeeding zooecia are typical except for the absence of frontal avicularia.

4. **Notoplites vanhöffeni** (Kluge). Fig. 10 A, B.

Scrupocellaria vanhöffeni Kluge, 1914, p. 610, pl. xxvii, fig. 6.

Notoplites vanhöffeni Harmer, 1923, p. 353.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, St. 190.

GEOGRAPHICAL DISTRIBUTION. Palmer Archipelago (Discovery); Wilhelm II Land (Kluge); Oates Land (Terra Nova); Ross Sea (National Antarctic Expedition; Terra Nova).

Comparison of this species with *Notoplites drygalskii* will be found on pp. 342, 340 (key). The internal spine is stout, and may be branched almost at its base, appearing paired (Fig. 10 B).

5. **Notoplites elongatus** (Busk). Figs. 12 A, B, 13 A.

Cellularia elongata Busk, 1884, p. 19, pl. iii, fig. 3.

Notoplites elongatus Harmer, 1923, p. 351.

STATION DISTRIBUTION. *Sub-Antarctic:* South Indian Ocean, Sts. 1562, 1563.

GEOGRAPHICAL DISTRIBUTION. Kerguelen (Busk); Marion Island (Discovery; 87.12.9.97 B).

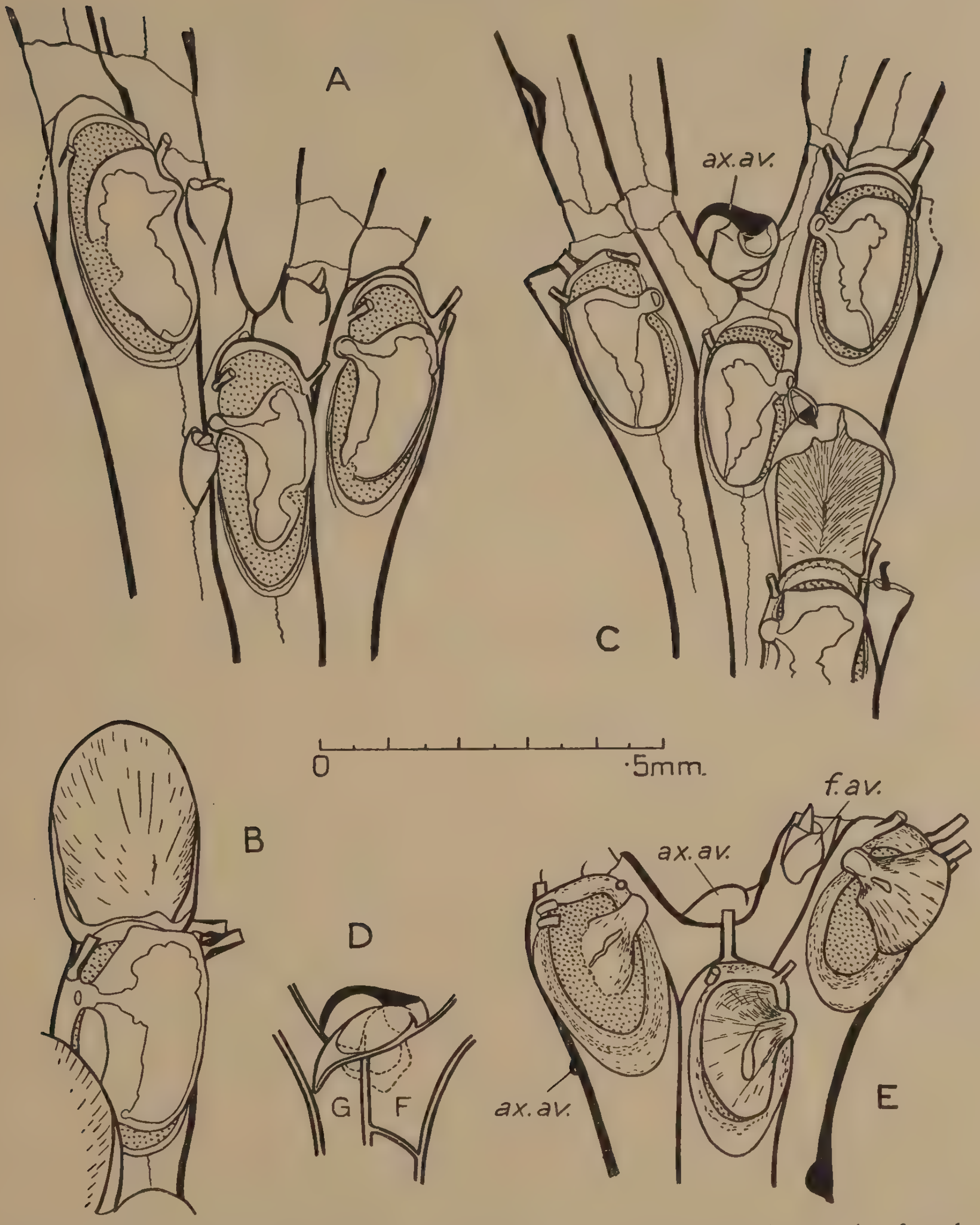

Fig. 12. A, B. *Notoplites elongatus* (Busk). A. From St. 1563, Marion Island. B. One zooecium from the type, 87.12.9.67. Challenger St. 149, Kerguelen. C, D. *N. elongatus* var. *calveti* var.n. St. WS 237, edge of Patagonian Shelf. C. Bifurcation. One marginal avicularium is broken. D. Basal view of axillary avicularium and neighbouring structures. Zooecia lettered according to Harmer's scheme. Portions of avicularium on frontal surface of branch shown by dotted lines. E. *N. crassiscutus* sp.n. St. 160, Shag Rocks. Zooecia preceding bifurcation. The tip of the axillary avicularium shows at the side of the branch.

ax.av. axillary avicularium, *f.av.* frontal avicularium.

The Discovery specimens from Marion Island differ from the type material from Kerguelen in the possession of frontal avicularia. These avicularia are small and are present on most of the zooecia, including one or both of the axillary zooecia (Fig. 12 A). Here they are placed proximally to the joint, with the beak turned towards the axil. In other respects the specimens agree very closely with the type. Oval areas may be present in the lateral walls (see p. 339).

A small colony of this species (87.12.9.97 B) was separated by Levinsen from the type material of *Amastigia kirkpatricki*, but left unnamed. Frontal avicularia are present on some zooecia, but not on the axillary ones.

One young colony with ancestrula (Fig. 13 A) was taken at St. 1563 (Marion Island, 7 April 1935). The ancestrula resembles that of *Notoplites tenuis* in shape. There are seven spines round the opesia and there may have been an eighth where the ancestrula is now broken. The first zooecium is connected to the ancestrula by a rather long tubular portion, and has seven spines and a small scutum. The second zooecium also has seven spines. The remaining nine zooecia have six spines each (4 : 2), but the scutum approximates to the adult form from the third zooecium onwards.

6. **Notoplites elongatus** var. **calveti** var.n. Fig. 12 C, D.

Cellularia elongata Calvet, 1904, p. 5.

Station distribution. *Sub-Antarctic:* South Atlantic Ocean, Sts. 51, WS 73, WS 79, WS 83, WS 84, WS 85, WS 88, WS 225, WS 237, WS 243, WS 244, WS 245, WS 247, WS 781, WS 794, WS 824, WS 825.

Geographical distribution. Patagonian Shelf (Calvet; Discovery); off Patagonian Shelf down to 315 m. (Discovery).

Holotype. St. WS 237, off Patagonian Shelf.

These specimens from the Patagonian region appear to constitute a distinct variety of *Notoplites elongatus*. They differ from the type material from Kerguelen in having an axillary avicularium in many of the bifurcations. There is also a slight difference in the ovicell, the calcified part of the ectooecium being more extensive in var. *calveti* (cf. Figs. 12 B and C). In both the typical form and the variety there is a narrow smooth cryptocyst and the edge of the gymnocyst bordering the aperture may be very finely beaded, but in var. *calveti* there is coarser beading on the distal border of the aperture of the fertile zooecium, a region which is smooth in the type. The scuta are similar in shape and show curved, longitudinal lines when dry. The shape of the lumen of the scutum is variable in both, but it is usually narrower proximally in var. *calveti* than in the typical form (cf. Figs. 12 A, B and C). Var. *calveti* also differs from the type material in possessing frontal avicularia, but, as described above, these are present in specimens from Marion Island, believed to belong to the typical form. The distribution of the avicularia is, however, different. When present in the typical form they are found on nearly all the zooecia. In var. *calveti* they are rarely found except in association with ovicells (Fig. 12 C) and on the median zooecium at the bifurcation.

The axillary basal avicularium originates from the side of zooecium F (Harmer's lettering), and projects into the axil. The opesia of the avicularium is on a level with the frontal surface of the branch (Fig. 12 C). The long, slender mandible is usually directed obliquely and is strongly arched, its articulation being on a level with the frontal surface of zooecium F, its tip lying basally to zooecium G (Fig. 12 D). In two instances the axillary avicularium was seen to be placed symmetrically in the axil with the mandible directed basally, but this position is exceptional. As Calvet mentions that his specimens from Patagonia had axillary avicularia, they presumably belong to this variety.

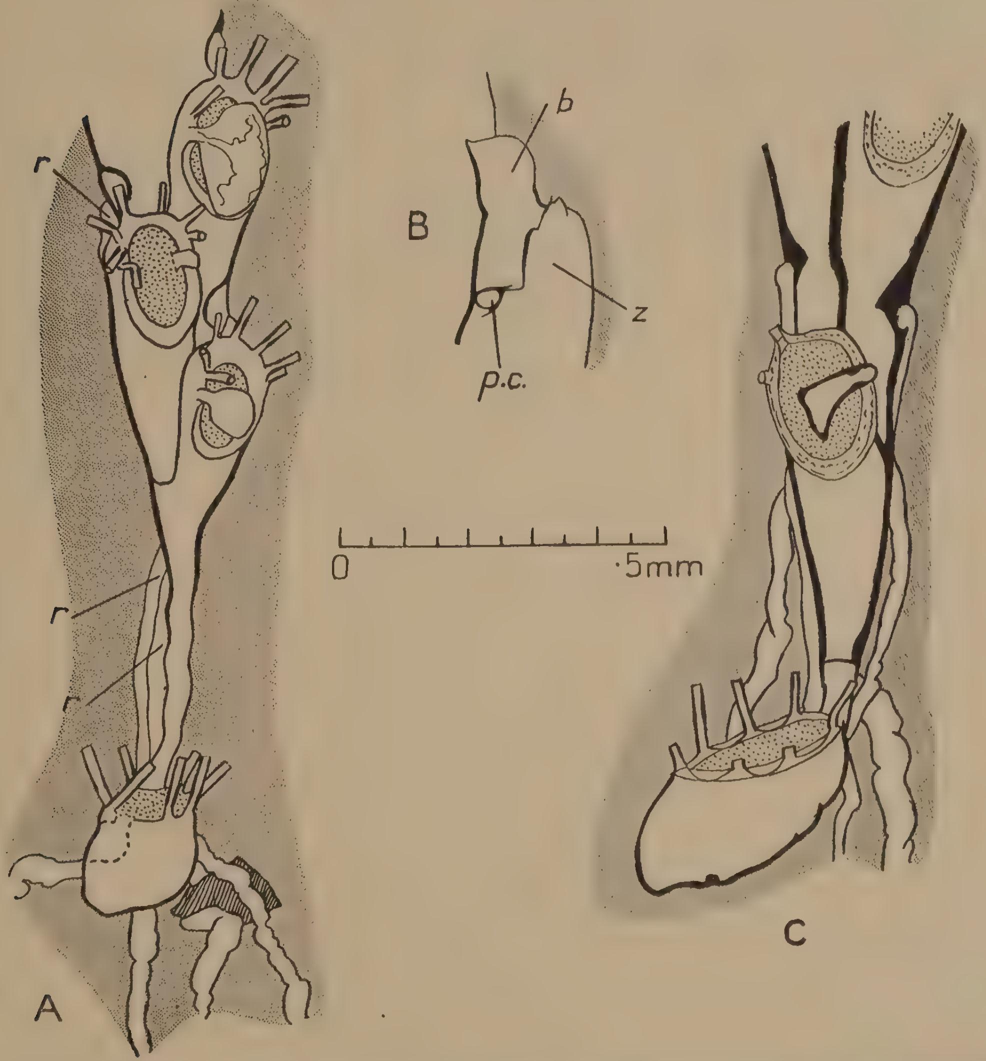

Fig. 13. A. *Notoplites elongatus* (Busk). St. 1563, Marion Island. Ancestrula and first three zooecia. The dotted line indicates a break in the ancestrula. Two of the rootlets are attached to a stone. B. *N. klugei* (Hasenbank). National Antarctic Expedition, McMurdo Sound. Bud and parts of neighbouring zooecia. C. *N. tenuis* (Kluge). St. TN 339, Ross Sea. Showing ancestrula.

b. bud, *p.c.* supposed pore-chamber, *r.* rootlets, *z.* proximal zooecium.

7. **Notoplites tenuis (Kluge).** Figs. 13 C, 15 C.

Scrupocellaria tenuis Kluge, 1914, p. 608, pl. xxvii, fig. 2.

Notoplites tenuis Harmer, 1923, p. 352.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, Sts. 39, 190, 366, 371; Victoria Quadrant, Sts. 1651, 1652, 1660.

GEOGRAPHICAL DISTRIBUTION. South Georgia; South Sandwich Islands; Palmer Archipelago (Discovery); Wilhelm II Land (Kluge); Oates Land (Terra Nova); Ross Sea (National Antarctic Expedition; Terra Nova; Discovery).

In these specimens there is considerable variation in the cryptocyst, which may, in adjacent zooecia, be distinctly granular, as figured by Kluge, or almost completely smooth. The spines, scuta and frontal avicularia are very irregularly distributed in the colony, and may be absent from many zooecia; for example, they are extremely rare in the material from St. 1652. The width of the blade of the scutum varies, so that scuta are sometimes seen which look like a flat spine turning at right angles to its base. The median zooecium at a bifurcation (E of Harmer) occasionally has two scuta, overlapping at the middle of the opesia. Basal and marginal heterozooecia have not been seen. The ovicells of a single colony may be round, as figured by Kluge, or taller and narrower. Oval areas may be present in the lateral walls of the zooecia (see p. 339 above). Testes of the usual type have been seen, consisting of very numerous clusters of cells filling the proximal part of the body-cavity.

Thirty-one[1] young colonies with ancestrulae have been found. The ancestrula is shallow (almost slipper-shaped) and lightly attached to the substratum by its basal surface (Figs. 13 C, 15 C). The opesia occupies the greater part of the frontal surface and is surrounded by spines. One zooecium is budded from the ancestrula. It is erect and its long axis is thus at right angles to that of the ancestrula. It is usually separated from the ancestrula by a joint. One or two zooecia (cf. Figs. 13 C and 15 C) are budded from the distal end of this first zooecium and typical biserial budding follows. A rootlet arises from each zooecium, including the first, but usually not from the ancestrula. These rootlets pass straight down the branch on to the substratum, usually leaving the ancestrula clear, but crossing it in one instance. From examination of older colonies it seems probable that the ancestrula breaks away fairly soon, leaving the colony slung by rootlets, the attachment of the ancestrula to the substratum being loose and the connexion between it and the first zooecium fragile. Occasionally the first zooecium has two to four spines, but usually it is typical, having one or none.

In the material from St. 1652 the first zooecium has in two instances given rise to a lateral zooecium as well as to the distal ones. The lateral zooecium arises at about the level of the proximal end of the opesia, and projects from the lateral wall of the zooecium at right angles. It is jointed near its proximal end, and gives rise to two distal buds. Similar lateral zooecia can also be budded from some of the subsequent zooecia. In the figured specimen (Fig. 15 C) the first two zooecia have formed lateral buds. In the same material a zooecium in the more distal parts of the colony sometimes forms a single distal bud, so that, for the length of one or two zooecia, the colony is uniserial. Here too the uniserial zooecia are jointed proximally.

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[1] Ancestrulae were obtained as follows: two from St. 39, 25 March 1926; four from St. 366, 6 March 1930; three from St. 371, 14 March 1930; six from St. 1652, 23 January 1936; one from St. TN 339, 24 January 1912; five from St. TN 340, 25 January 1912; eight from the east end of the Barrier (National Antarctic Expedition), 29 January 1902; two from McMurdo Sound (National Antarctic Expedition), 13 February 1902.

8. Notoplites tenuis var. uniserialis var.n. Fig. 14 A–C.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Oates Land (Terra Nova); Ross Sea (National Antarctic Expedition).

HOLOTYPE. St. TN 194.

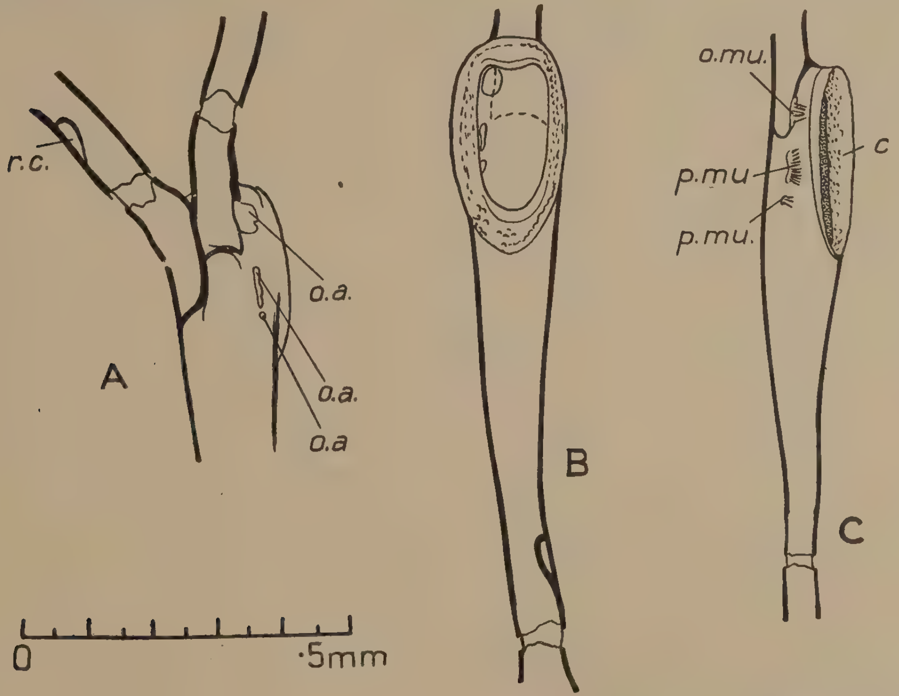

Fig. 14. A–C. *Notoplites tenuis* var. *uniserialis* var.n. St. TN 194, off Oates Land. A. Slightly oblique view of bifurcation. B. Zooecium in oblique frontal view. C. Zooecium in side view. Opesia stippled. *c.* cryptocyst, *o.a.* "oval areas", *o.mu.* occlusor muscle, *p.mu.* parietal muscle, *r.c.* rootlet-chamber.

This variety is represented by fifteen fragments, with two to twelve zooecia each. The zooecia are indistinguishable from those of *Notoplites tenuis* except that they are a little more slender (Fig. 14 B, C). Scuta and avicularia are absent (as they are on many zooecia of *N. tenuis*). As in *N. tenuis* the cryptocyst may be smooth or granular. The fragments are constantly uniserial and they bifurcate by the formation of a pair of distal buds (Fig. 14 A). Zooecia formed from lateral buds projecting at right angles to the zooecia are common. As uniserial zooecia and lateral buds have also been seen in *N. tenuis* (see p. 350) there seems to be no reason to give this form more than varietal rank. Each zooecium is jointed proximally, as in the uniserial zooecia of typical *N. tenuis*. Ovicells are unknown.

This may be *Brettia longa* Waters (1904, p. 26, pl. i, fig. 2*b*, not 2*a*; Kluge, 1914, p. 642). The "disks" described by Waters are evidently the "oval areas" (see p. 339 above) and are to be seen in these specimens, but the small frontal pores are absent and the distal spine though present in the uniserial zooecia of typical *Notoplites tenuis* is absent in the variety. The chief discrepancy is in the bifurcation. Waters's figure is difficult to interpret, but it can hardly represent the arrangement in var. *uniserialis* where the proximal segments of the daughter zooecia are in contact on the basal surface of the parent zooecium, one being slightly more proximal in origin than the other. The relation of the two daughter zooecia with the parent zooecium is, in fact, closely similar to that of zooecia F and G (Harmer's lettering) with zooecium E in the bifurcations of *N. tenuis*. The zooecia in Kluge's specimens of *Brettia longa* had a small spine at each distal corner. Lateral buds were formed. Waters's fig. 2 *a* is discussed on p. 470.

9. **Notoplites klugei** (Hasenbank). Fig. 13 B.

Menipea klugei Hasenbank, 1932, p. 369, text-fig. 33.

Scrupocellaria simplex Kluge, 1914, p. 607, pl. xxvii, fig. 1.

Notoplites simplex Harmer, 1923, p. 353.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Bouvet Island (Hasenbank); Wilhelm II Land (Kluge); Ross Sea (National Antarctic Expedition).

This species, which is represented by one small piece, differs from *Notoplites tenuis* in its larger opesia and shorter zooecia; in the more nearly oval outline of the aperture, which in *N. tenuis* tends to have a rather straight distal border; in the absence of spines and scuta; in the occasional presence of a small marginal avicularium; and in the less complete development of joints. Kluge and Hasenbank both refer to the apparently primitive state of the joints. Kluge correctly describes the joints as being, when present, no more than breaks in the calcareous wall without special chitinous tubes, thus corresponding to the early stages in the formation of more highly developed joints. From what has been said above about the variation in the degree of granulation of the cryptocyst in *N. tenuis*, it will be seen that the smooth cryptocyst of *N. klugei* does not afford a distinguishing character. There is a small chamber projecting from the proximal wall of each zooecium. In the few zooecia mounted they are very variable in size and shape. The smallest and simplest is figured (Fig. 13 B). As far as one can tell from very scanty material these chambers are a constant feature of this species. I have not seen them in the much more abundant material of the other species of *Notoplites*, though they are described in other genera of this family by Levinsen (1916, pp. 436, 438) and Harmer (1923, p. 347), who both regarded them as pore-chambers.

The method of bifurcation, including the position of the joint when present, shows that Harmer was right in tentatively associating this species (as *Scrupocellaria simplex* Kluge) with *Notoplites*. Hasenbank transferred it to *Menipea*, and, as the name *Menipea simplex* was preoccupied by *M. simplex* nom.nud. Kirchenpauer (1889, p. 288), he introduced the name *M. klugei* for Kluge's species. According to Article 36 of the

International Rules of Nomenclature a name once suppressed as a homonym cannot be used again. The rule presumably applies here, and I therefore retain Hasenbank's specific name.

10. **Notoplites crassiscutus** sp.n. Figs. 12 E, 15 A, B, 16 A, B.

Station distribution. *Antarctic:* Weddell Quadrant. Sts. 42, 160.

Geographical distribution. South Georgia; Shag Rocks (Discovery).

Holotype. St. 160, Shag Rocks.

Description. *Zoarium* of the type characteristic of the genus, biserial (Fig. 15 A).

Zooecia slender, with oval opesia and wide, more or less granular, cryptocyst (Fig. 15 A, B).

Spines, three external, one internal.

Scutum large and stout, proximal lobe usually the larger, lumen small, linear or with a proximal arm at right angles, outer surface with striations radiating from stalk.

Frontal avicularia small, often present on median zooecium (E), at bifurcation, sometimes on axillary zooecium (F or G), placed on portion proximal to joint (Fig. 12 E), occasionally on other zooecia.

Marginal avicularia absent.

Basal avicularia (Figs. 12 E, 15 A, 16 A) at each bifurcation originating from zooecium F (Harmer's lettering) with very long slender mandible directed from axil along basal surface of branch in obliquely proximal, occasionally almost transverse, direction.

Ovicells unknown.

Remarks. In the specimen from St. 42 the lumen of the scutum tends to be more extensive and the striations are less conspicuous than in the type, but there is a good deal of variation, some scuta having lumina like those of the type specimen. In both specimens there is considerable variation in the degree of granulation of the cryptocyst. The figured zooecia show the maximum and minimum.

Notoplites crassiscutus appears to be more nearly related to *N. elongatus* (Busk) than to other species. It differs from *N. elongatus* in the absence of marginal avicularia, in its granular cryptocyst, and in its scutum, which is similar in shape, but has its lumen greatly reduced and its frontal surface convex and radially striated. Like *N. elongatus* var. *calveti*, *N. crassiscutus* has an axillary avicularium, with long slender mandible, originating from zooecium F. In var. *calveti* the mandibular surface of this avicularium is strongly convex, the opesia facing towards the frontal surface of the colony and the mandible arching round so that its distal part lies along the basal surface of the branch (Fig. 12 C, D); but in *N. crassiscutus* the mandible and opesia of the avicularium are not visible in a frontal view, the mandibular surface being relatively flat and entirely on the basal surface of the branch (Fig. 16 A), part of the chamber alone being visible in a frontal view of the branch (Figs. 12 E, 15 A). Although the avicularium is larger, a much smaller part of it is actually in the axil in *N. crassiscutus* than in var. *calveti*. The mandible in *N. crassiscutus* is longer and may project beyond the margin of the branch.

N. tenuis differs from *N. crassiscutus* in having longer zooecia of more uniform width;

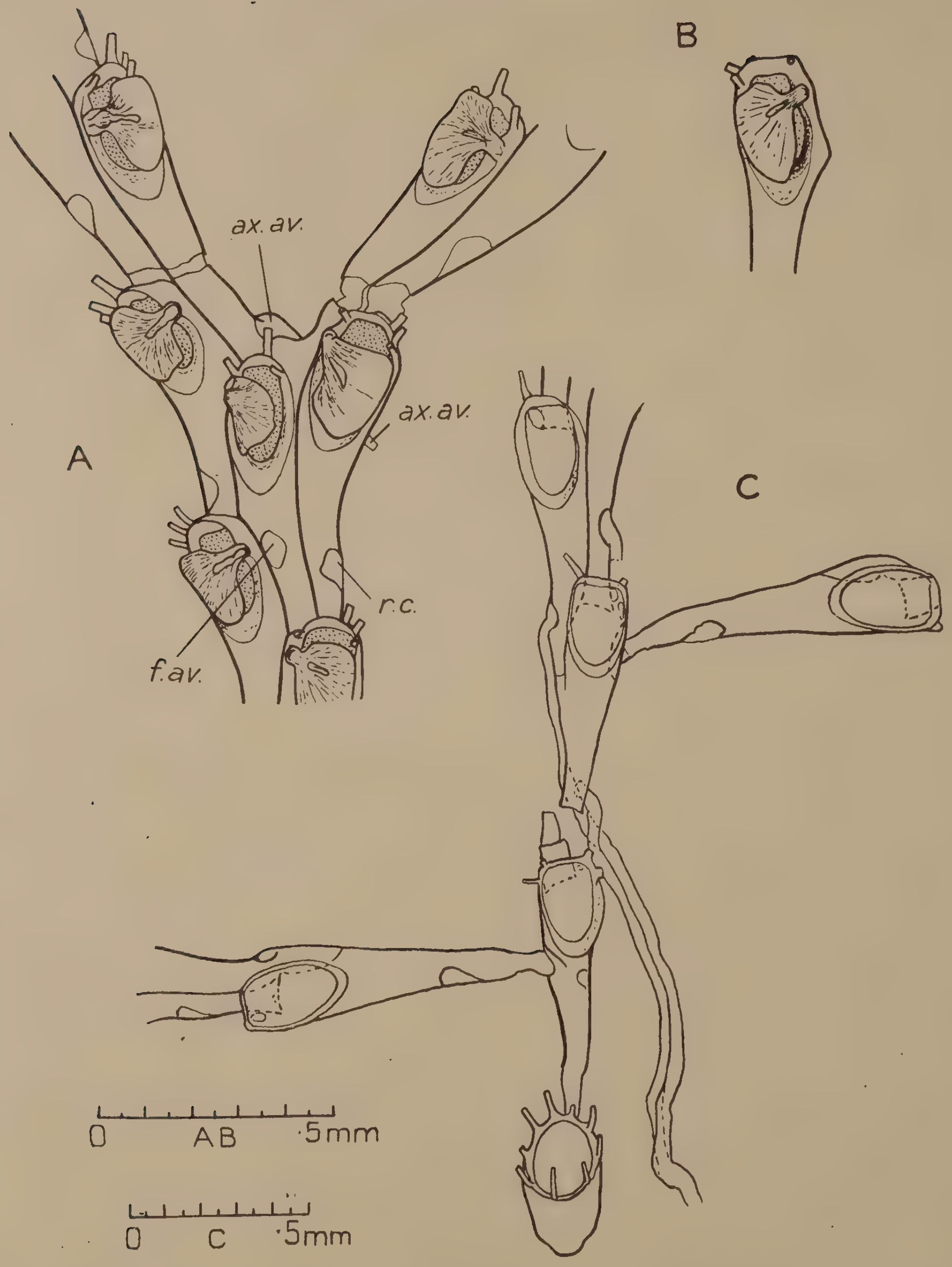

Fig. 15. A, B. *Notoplites crassiscutus* sp.n. St. 160, Shag Rocks. A. Frontal view. B. Zooecium with more granular cryptocyst than those in A. C. *N. tenuis* (Kluge). St. 1652, Ross Sea. Showing ancestrula and lateral branches.

ax.av. axillary avicularium whose tip projects at the side of the branch, *f.av.* frontal avicularium (incomplete), *r.c.* rootlet-chamber.

in its less numerous spines and in the raised border to the aperture; in the shape of the scuta and in the absence of axillary avicularia.

All three species agree in the possession of areas (Fig. 16 B) in the lateral walls corresponding to the muscle attachments (see p. 339).

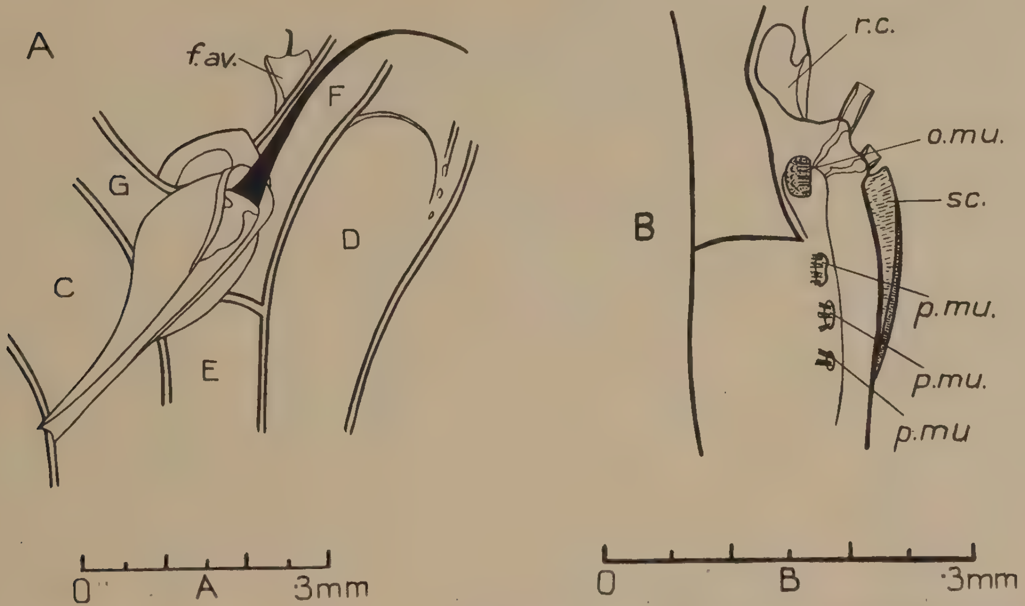

Fig. 16. A, B. *Notoplites crassiscutus* sp.n. St. 160, Shag Rocks. A. Basal view of axillary avicularium. Underlying zooecia outlined, and lettered according to Harmer's scheme. B. Oblique basal view of parts of two zooecia.

f.av. frontal avicularium of zooecium F, *o.mu.* occlusor muscle, *p.mu.* parietal muscles, *r.c.* rootlet-chamber in thickness of wall, *sc.* scutum.

11. Notoplites perditus (Kluge).

Scrupocellaria perdita Kluge, 1914, p. 613, text-fig. 2.

Notoplites? perditus Harmer, 1923, p. 353.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Southern Ocean, 2450 m. (Kluge).

Notoplites perditus, which I have not seen, has quite conspicuous marginal avicularia and a small uncalcified area in the ectooecium, thus resembling the members of the *N. antarcticus* group (see Key p. 340, bifurcation 2). Kluge does not mention internal spines, but as he mentions them in only one of the four members of the group, and as he described *N. perditus* from a small fragment which was lost after only a preliminary examination, they may yet prove to be present. Frontal avicularia appear to have been absent, and the rounded scutum with a small, sharply demarcated, distal lobe would, if constant, be characteristic.

Tricellaria Fleming, 1828

1. Tricellaria monotrypa (Busk). Fig. 17 A.

Cellularia monotrypa Busk, 1852*a*, p. 368.

Cellularia cuspidata Busk, 1852*b*, p. 19, pl. xxvii, fig. 12.

Tricellaria monotrypa Harmer, 1923, p. 355.

Bugulopsis cuspidata Stach, 1937, p. 378.

STATION DISTRIBUTION. *New Zealand:* St. 934.

GEOGRAPHICAL DISTRIBUTION. New Zealand (Busk; Terra Nova; Discovery); Bass Strait (Busk; Livingstone).

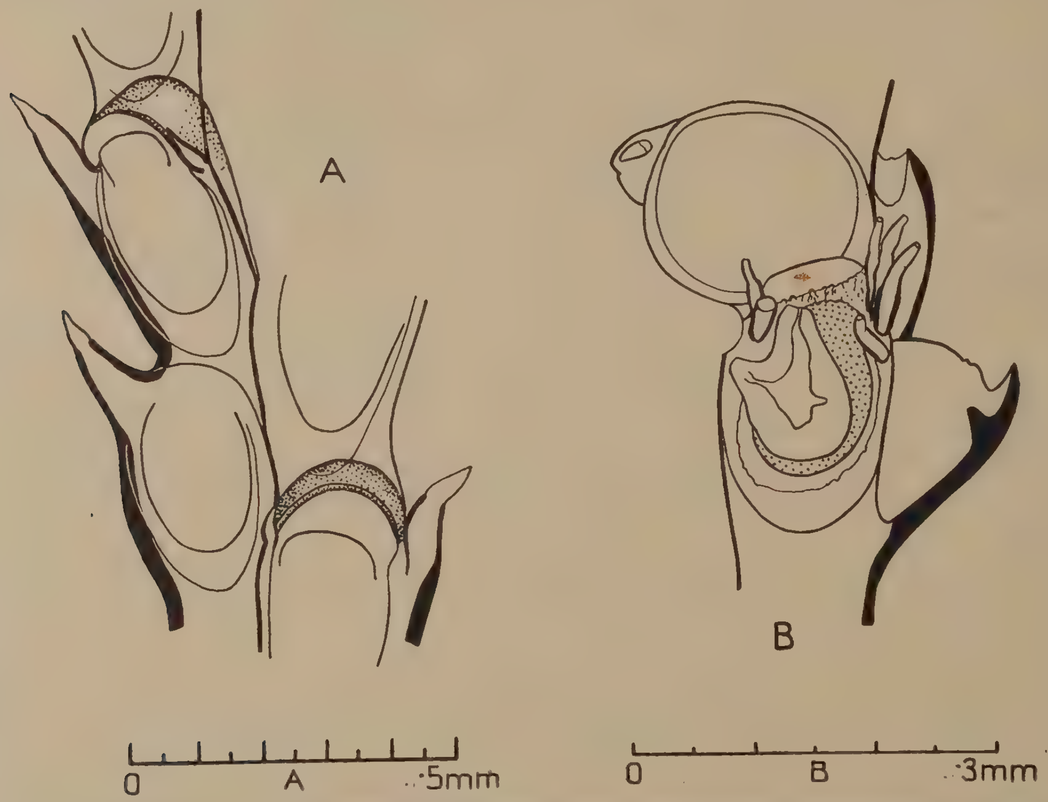

Fig. 17. A. *Tricellaria monotrypa* (Busk). St. 934, New Zealand. Fertile and non-fertile zooecia. B. *Scrupocellaria ornithorhyncus* (Thom.). 97.5.1.219. Port Phillip Heads. To show tuberculation of distal border of aperture of fertile zooecium. Curious shapes of spines may be due to regeneration.

The ovicell (Fig. 17 A) was observed and described by Busk (1852*a*). It is shallow and endozooecial, incapable of accommodating the whole embryo. The fertile zooecium bears a little spike-like spine on the inner distal corner, curved towards the ovicell.

2. Tricellaria aculeata (d'Orbigny).

Bicellaria aculeata d'Orbigny, 1847, p. 8.

Tricellaria aculeata d'Orbigny, 1842, pl. ii, figs. 1–4; Harmer, 1923, p. 355; Monod and Dollfus, 1932, p. 61.

Menipea fuegensis Busk, 1852*b*, p. 21, pls. xix, figs. 1–3; Jullien, 1888, p. 70, pl. vii, figs. 8–10, pl. xii, figs. 1, 2; Calvet, 1904, p. 6; Vallentin, 1924, p. 373; Hasenbank, 1932, p. 365.

Menipea aculeata Busk, 1884, p. 20, pl. iv, fig. 2; Calvet, 1904, p. 6; Marcus, 1921*b*, p. 93; Vallentin, 1924, p. 373.

Scrupocellaria fuegensis Waters, 1904, p. 24.

Scrupocellaria bifurcata Kluge, 1914, p. 614, text-fig. 3.

Menipea patagonica (part) Busk, 1852*b*, pl. xxiii, fig. 1.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. 51, 53, 652, 1230, 1902, WS 72, WS 79, WS 84, WS 85, WS 87, WS 88, WS 95, WS 220, WS 222, WS 244, WS 245, WS 838, WS 847, WS 871.

GEOGRAPHICAL DISTRIBUTION. Chile (Busk); Magellanic Region (Busk; Jullien; Waters; Calvet; Hamburg Museum, B. 1205; Discovery); Patagonian Shelf (d'Orbigny; Busk; Calvet; Vallentin; Discovery); off Patagonian Shelf down to 339 m. (Discovery); Kerguelen (Busk; Kluge; Hasenbank; Monod and Dollfus); South Georgia (Calvet); Bouvet Island (Hasenbank); Campbell Island (Marcus); Auckland Island (National Antarctic Expedition); New Zealand (Hamilton; 97.5.1.265; 99.7.1.734).

The synonymy of this species has been discussed by Waters, Marcus and Harmer. Waters considered that he had no proof that there were not three distinct species. Marcus accepted *Tricellaria aculeata* (Busk) as the form intended by d'Orbigny and thought that *T. fuegensis* (Busk) was probably the same thing, but was not satisfied about *T. fuegensis* (Jullien). Harmer regarded them all as representing a single variable species, and after examining the Discovery collection and the specimens in the Busk and other collections in the British Museum I agree with him.

In the one small colony from Challenger St. 314 zooecia can be seen in which the scutum is simple and unbranched, bears two, three or four points, or is completely absent; the lateral avicularium may be present or absent and varies in size; the frontal avicularium is occasionally absent and the distal spines may be stout or slender, long or short, varying in number from two to four. The zooecia are more delicate and slender than in the specimen described by Busk in 1852, but other specimens are more or less intermediate. I therefore regard *T. aculeata* (Busk) and *T. fuegensis* (Busk) as synonymous. Marcus was doubtful whether there might not be a difference in the cryptocyst of these two forms, but I have not detected any.

Apart from features that have already been shown to be variable, such as the scutum and spines and the presence or absence of frontal avicularia, the chief feature mentioned by Waters as distinguishing *T. fuegensis* (Jullien) from *T. fuegensis* (Busk) is the large number of zooecia in the fertile internodes of the former (3–14 in the figure). Ovicells are completely absent from Busk's type-specimen but were on short internodes in Waters's own specimen which agreed with *T. fuegensis* Busk in other respects. In the present material the number of the zooecia in the fertile internodes varies from three to fifteen. Those colonies with the longest internodes (namely, those from St. 53, in which the full range from three to fifteen is found, and some from the Falkland Islands, 24.9.1.1, with a maximum internode of ten zooecia) have certain features in common with Jullien's figure. The non-fertile internodes consist of relatively long, stout zooecia, and are less tapering proximally and less sinuous in outline than those of colonies with shorter fertile internodes. Most of the zooecia have no frontal avicularia, and the lateral avicularia, which are not present on all the zooecia, have their palatal surface tilted obliquely towards the frontal surface of the colony. The scutum is usually unbranched and not much curved over the opesia, commonly having the appearance of an extra spine rather than a typical scutum. Other specimens are, however, more or less intermediate between *T. fuegensis* (Busk) and *T. fuegensis* (Jull.). For example, some fragments from St. WS 85, with as many as nine zooecia in a fertile internode, have slender zooecia, branched scuta, lateral avicularia not tilted and often absent, frontal avicularia commonly present; and in Kluge's figure of a specimen from Kerguelen (described as *Scrupocellaria bifurcata*), also with nine zooecia in the fertile internode, some of the avicularia appear to have the oblique palatal surface, and the non-fertile internode is straight and fairly stout, but frontal avicularia are present, and the scuta are well developed and curved over the opesia.

Kluge regarded his *S. bifurcata* as differing from *Tricellaria aculeata* (Busk) chiefly in the presence of a marginal avicularium, which he recognized as a variable character, and in the presence of four distal spines on most zooecia, but some specimens from the Falkland Islands may have four spines on most of the zooecia (Vallentin Coll. 35.3.6.298 and 377), and the majority of South American specimens have four on some zooecia. Material from Kerguelen in the British Museum shows similar variation; that of Busk 1879 has four spines on some zooecia and four are commonly present on the zooecia of specimens found among unnamed material from Challenger St. 149 (34.11.12.78). Hasenbank's specimens from Bouvet Island are described with four to six spines. All this strongly supports Harmer's conclusion that *Scrupocellaria bifurcata* Kluge is a synonym of *Tricellaria aculeata*.

Considering the irregularity of the distribution of avicularia and scuta and the variability in their size, the less powerful optical instruments of a century ago, and the fact that d'Orbigny's specimens come from the same region as those since described, a region from which no specimens agreeing more exactly with his figures are known, I agree with Harmer and Marcus that one should accept d'Orbigny's name for this species.

All the material from New Zealand that I have examined has short rather strongly calcified zooecia with usually four or five spines on the distal zooecium of the internode.

Canu and Bassler (1929, p. 224) put this species into a new genus *Monartron* with *Menipea* [*Emma*] *cyathus* Thomson as genotype. *M. cyathus* differs from the other species of *Emma*, as understood by Harmer (1923), in its hyperstomial ovicell, slight cryptocyst and uniserial joints, and one can quite well argue that it should be separated from *Emma*, but, except for the one character of the uniserial joints, *Tricellaria aculeata* resembles *T. ternata* (genotype of *Tricellaria*) more closely than it does *Menipea cyathus*. Whatever views one may hold about the position of *M. cyathus* there is clearly no justification for separating *Tricellaria aculeata* from *T. ternata* in order to associate it with *Menipea cyathus*.

Busk's figure (1852*b*, pl. xxiii, fig. 1), supposed to represent the ancestrula and first few zooecia of *M. patagonica*, agrees so closely with the type-specimen of *Tricellaria* *fuegensis* (54.11.15.262) that it must have been drawn from it. The basal parts of the colony differ from the corresponding parts of true *Menipea patagonica* (Fig. 6 A) in the shape of the ancestrula; in the smaller number of zooecia in the first two internodes; in the more or less frontal origin of the rootlets; and in the presence of scuta, of which the bases now remain. In the specimen figured by Busk the first internode consists of one zooecium. In the Discovery material from St. WS 84 (24 March 1927), and specimens belonging to the Hamburg Museum (B. 1025) and the U.S. National Museum, there are three zooecia in the first internode. The ancestrula figured by Jullien (1888, pl. vii, fig. 8) is a little taller than those examined by me.

3. Tricellaria sp.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Challenger St. 299, off Valparaiso, 3953 m. (99.7.1.4564).

DESCRIPTION. *Zoarium* biserial, bifurcation of Harmer's type 9 with one branch (the one including zooecia CG) at each bifurcation unjointed.

Zooecia raised distally, opesia more or less oval with thin raised edge, tubular proximal portion forming more than half and often more than two-thirds of length of zooecium, frequently with faint transverse striations.

Spines: 2 to 4 long curved spines arranged in an oblique row running from outer distal corner across basal surface of projecting distal end of zooecium; frequently a stout straight spine on raised edge of inner border of opesia towards proximal end, directed frontally.

Scutum absent.

Rootlets springing laterally from portion of zooecium C proximal to joint and from proximal part of some other zooecia; not applied to surface of colony.

Avicularia and ovicells not seen.

REMARKS. The single small specimen of this species was found in the Busk Collection, labelled *Bicellaria*. It was only discovered after some of the books and specimens necessary for its proper comparison with known species had been stored for safety during the war. It is, however, certainly distinct from seven of the eight species included in *Tricellaria* by Harmer (1923, p. 354). The description of the eighth species, *T. pribilofi*, is not available. It is probably also distinct from Harmer's two additional species (1926, pp. 356, 358).

In its bifurcation, with one branch unjointed, *Tricellaria* sp. resembles *T. sympodia* (Yanagi and Okada, 1918, p. 410, Japan 457·5 m.), and *T. aquilina* and *T. scalariformis* Harmer (1926, Malay Archipelago 2081 m. and 270–469 m. respectively).[1] It differs from all three in the absence of avicularia, in its free rootlets and in the number and arrangement of its spines. It appears to be most nearly related to *T. aquilina* which it resembles in the separation of the bases of zooecia F and G on the basal surface of E. The long spines on the inner margin of the opesia may be on zooecium A or B, or (in one instance) on one of the zooecia on the undivided sympodial branch. They are placed more proximally and directed more frontally than in *T. aquilina*. The opesia is usually a little shorter than in *T. aquilina*.

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[1] See Addendum, p. 501.

Emma Gray, 1843

1. Emma triangula Hastings.

Emma triangula Hastings, 1939, p. 323, text-fig. 272 A.

STATION DISTRIBUTION. *New Zealand:* Sts. 934, 935.

GEOGRAPHICAL DISTRIBUTION. Australia; New Zealand (Hastings).

Scrupocellaria Van Beneden, 1845

1. Scrupocellaria ornithorhyncus Thomson. Fig. 17 B.

Scrupocellaria ornithorhyncus Thomson, 1858, p. 144.

Scrupocellaria ornithorhynchus Busk, 1884, p. 24, pl. xi, fig. 6; MacGillivray, 1886*b*, p. 102, pl. cxxvi, figs. 9, 9 *a–c*; 1887*b*, p. 200; Livingstone, 1929, p. 53.

Scrupocellaria pilosa Busk, 1884, p. 24, pl. xi, fig. 7.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. 4, 5, 339, 1321. *New Zealand:* St. 934. *Victoria:* St. 1686.

GEOGRAPHICAL DISTRIBUTION. Victoria (Thomson; MacGillivray; Discovery); Tasmania (50.1.21.19); Sandwich Islands (Busk[1]); New Zealand (Livingstone; Discovery); Island of South Trinidad, off Brazil (Terra Nova); John Adams Bank, off Brazil (1937.10.14.1); Tristan da Cunha (Busk; Discovery); Gough Island; Magellanic Region (Discovery).

The Discovery specimens from Tristan agree exactly with those from the same group of islands wrongly determined by Busk (1884, p. 24) as *Scrupocellaria pilosa* Aud. (see Harmer, 1926, p. 383). The species from Tristan agrees very closely with Australian specimens believed to belong to *S. ornithorhyncus* Thomson. In both, the distal border of the aperture is tuberculate in fertile zooecia (Fig. 17 B); the full complement of spines appears to be four outer and two inner; and some of the marginal avicularia are large, and have a stout, sharp-pointed end to the beak, as figured by both Busk and MacGillivray. MacGillivray described *S. ornithorhyncus* as having a bifurcate or double spine close to the base of the scutum, but he was probably misled by the very close approximation of the two inner spines. With one exception the spines in his figure accord with this interpretation.

Busk described the Tristan species as slender, and *S. ornithorhyncus* as very slender, though his figures (1884, pl. xi, figs. 6*a*, 7*a*) depict *S. ornithorhyncus* as the stouter of the two. In reality there is no appreciable difference in this respect between his specimens. There is some variation in the stoutness of the branches in the British Museum material as a whole, but this appears not to be correlated with distribution. Thomson described the cryptocyst of *S. ornithorhyncus* as granular ("tuberculated crescentic plate"), but Busk described both forms as having smooth cryptocysts. In reality both are variable; a few distinct granulations are sometimes to be seen in specimens from Tristan, and in Australian material zooecia with quite smooth cryptocysts can be found.

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[1] A specimen in the Busk Collection, collected by the 'Challenger' at the Sandwich Islands, and labelled *S. ornithorhynchus*, proved to be wrongly identified (see Harmer, 1926, p. 370), but true *S. ornithorhyncus* was also obtained from that locality by the 'Challenger' (87.12.9.108).

In the material from the Magellan region the marginal avicularia are all of the same, rather small, size, and in the New Zealand specimen the larger ones are not so large as usual. Both these specimens have the cryptocyst smooth, and are rather slender. Ovicells are not present.

S. ornithorhyncus is distinguished from British specimens of *S. scrupea* by several small but definite differences. The marginal avicularia are farther from the distal end of the zooecium in *S. ornithorhyncus*, often being entirely proximal to the spines and always extending as far back as the proximal end of the opesia, or farther. The fertile zooecia of *S. scrupea* have a smooth distal wall. Other differences are less definite. *S. scrupea* has as a rule stouter branches, with less markedly serrated borders (because of the smaller marginal avicularia), and more zooecia in the internodes. Its scutum is blunter distally and I have seen no specimen with more than three outer spines. In both species the joint may just touch the proximal border of the opesia of the outer zooecium, but in *S. scrupea* it sometimes passes through the proximal part of the opesia, whereas in *S. ornithorhyncus* it is commonly in the proximal gymnocyst at a distance from the opesia.

The supposed Australian specimens of *S. scrupea* in the British Museum, including those in the Bracebridge Wilson collection (97.5.1.219, 220) which probably represent the form called *S. scrupea* by MacGillivray, belong to *S. ornithorhyncus*, and it seems possible that some other published records of *S. scrupea* may be based on this species. For example, *S. scrupea* Marcus (1937, p. 56; 1938*b*, p. 208), from Brazil and St Helena, may be *S. ornithorhyncus*. Both specimens had four outer spines and the figure (1937, pl. xi, fig. 27 A) shows most of the marginal avicularia in the more proximal position. On the other hand, the character of the distal wall of the fertile zooecium does not appear, and the branch is as stout as those of *S. scrupea*. No evidence is available about the specific characters of *S. scrupea* Stach (1937, p. 379). Harmer (1926, p. 382) has shown that *S. scrupea* Philipps is a synonym of *S. spatulata* (d'Orbigny).

2. **Scrupocellaria frondis** Kirkpatrick. Fig. 18 A–D.

Scrupocellaria frondis Kirkpatrick, 1890, p. 504, text-fig. 1.
not *Scrupocellaria frondis* Thornely, 1912, p. 140.

STATION DISTRIBUTION. *Ascension Island:* St. 1.

GEOGRAPHICAL DISTRIBUTION. Fernando Noronha; Pernambuco (Kirkpatrick); Ascension Island Discovery); Tortugas (31.12.9.7).

This species, originally described from a few fragments, may usefully be redescribed here.

DESCRIPTION. *Zoarium* branches rather straight and not widely divergent.

Zooecia (Fig. 18 B) smaller than those of *Scrupocellaria bertholletii*. Opesia oval, occupying about one-half length of zooecium, filled by scutum, no cryptocyst. Lumen of scutum usually constricted or closed at a point near stalk, with three or four recurved, undivided branches on each side. Spines three external, two internal, and, on non-fertile zooecia, one distal. Proximal external spine curved across aperture, cervicorn in most zooecia, with two to five tines, and crossing proximal internal spine which is stout, unbranched, and curved across aperture.

Frontal avicularia small, absent from many zooecia, slightly larger on median zooecium at bifurcation.

Lateral avicularia absent.

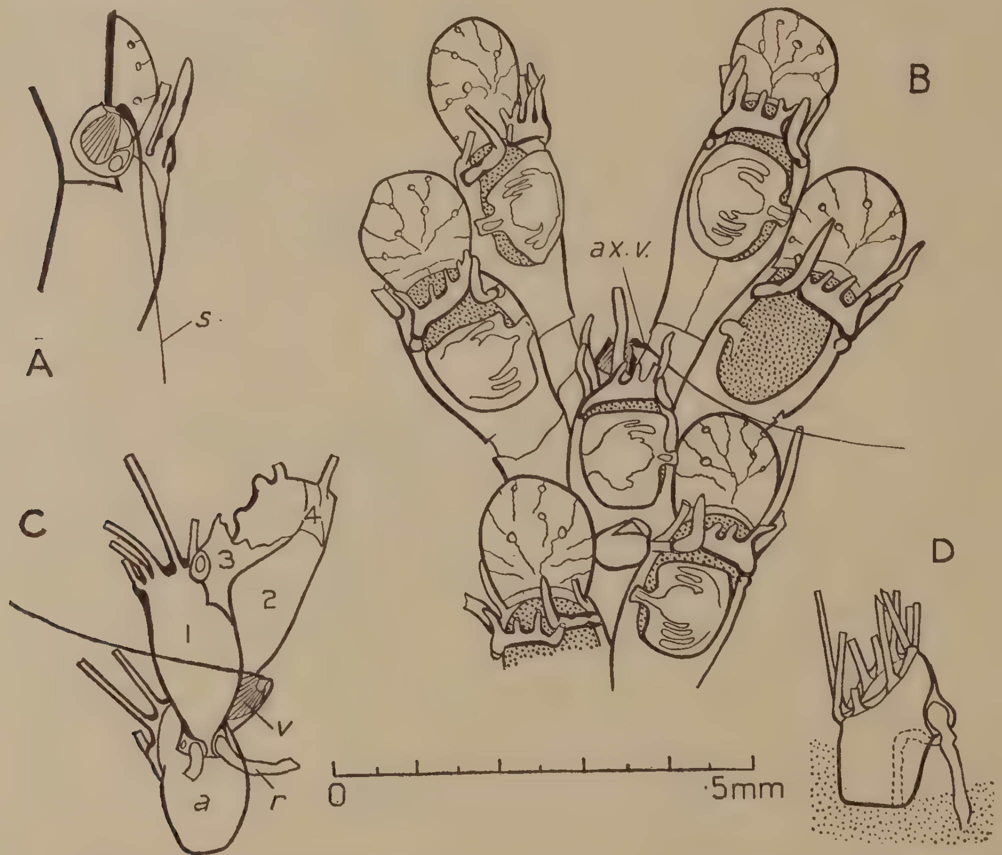

Fig. 18. A–D. *Scrupocellaria frondis* Kirkpatrick. A. 31.12.9.7. Dry Tortugas. Basal view showing vibraculum and adjacent structures. B. 31.12.9.7. Dry Tortugas. Frontal view. C. St. 1, Ascension Island. Young colony in slightly oblique basal view. D. 31.12.9.7*c*. Dry Tortugas. Ancestrula with rootlets and rudiments of first zooecium. Polypide omitted.

a. ancestrula, *ax.v.* axillary vibraculum, *r*. rootlet, *s*. seta, *v*. vibraculum, 1–4, first four zooecia.

Vibracula (Fig. 18 A). Vibracular chamber not visible in frontal view of branch, longer than wide, with lateral rootlet chamber, whole structure nearly circular, truncated distally by transverse vibracular groove. Seta long and fine. One small vibraculum in axil of bifurcation.

Ovicells longer than wide, with a few pores connected by radiating sutures.

Rootlets smooth.

Remarks. The Discovery specimens agree very closely with the type and with the specimens from the Tortugas figured here. The branches of the lumen of the scutum are sometimes not quite so much recurved.

In the specimen from Pernambuco some zooecia agree very closely with the type, but in others the branched spine has fewer tines and is less curved.

Several species with similar scuta are known from the tropical region of the Atlantic. Smitt (1872, pp. 13, 14) described three from Florida as *S. cervicornis* (Pourt.),[1] *S. cornigera* (Smitt) and *S. pusilla* (Smitt), and Waters described *S. tridentata* from the Cape Verde Islands. Professor R. C. Osburn has found Smitt's three species at the Tortugas, and has very kindly sent me specimens of *S. cervicornis* (35.11.26.3) and *S. cornigera* (35.11.26.2) and examined part of my material. *S. pusilla*[2] is represented in the British Museum by some fragments from John Adams Bank, off Brazil (99.7.1.786, 787). Smitt's figures are accurate in all matters of importance, and there can be no doubt that *S. frondis* is distinct from all three species. The bifid spine is a variable feature and I have seen it in both *S. cervicornis* and *S. cornigera* (cf. Marcus, 1937, pl. xi, fig. 26 A). *S. frondis* differs from both these species in the presence of the large cervicorn spine, in the rounded scutum which never has the sharply pointed corners, in the absence of lateral avicularia, and in the shape of the vibracula. The vibracular chambers of *S. cervicornis* not only differ in shape, but are conspicuous in frontal view. *S. pusilla* is a smaller, more delicate species. Its scutum is similar to that of *S. frondis*, but it has no cervicorn spines, its vibracula are very different in shape, it has lateral avicularia and its branches are more sinuous in outline.

Professor Osburn tells me (in a letter, 1935) that his *S. cervicornis* (1914, p. 192) is the true *S. cervicornis* Smitt, that its "cervicorn" spines would have been better described as bifid, and that he has not before seen the species with the truly cervicorn spine.

S. cervicornis Verrill (1900, p. 593) from Bermuda may have been one of these species, but in the absence of any mention of branched spines is probably not *S. frondis*.

S. tridentata Waters possesses lateral avicularia, and enlarged trifurcate frontal avicularia below the bifurcation, and has the spines arranged differently and all unbranched.

The vibraculum of *S. frondis* resembles that of *S. bertholletii* (Audouin), a species whose rather larger zooecia have the same number of spines, but all unbranched, and similar ovicells. The scuta of the two species are markedly different. The absence of lateral avicularia is a distinction from specimens of *S. bertholletii* so far described, but colonies from the Tortugas (Colman-Tandy Coll. 31.12.19.4; Professor Osburn, 35.11.26.1), and from Mozambique (1938.5.2.4), which otherwise agree exactly with that species, have none.

Thornely has noted that the form recorded by her as *S. frondis* differs from Kirkpatrick's species in the presence of marginal avicularia and the shape of the scutum. These points are confirmed by examination of her specimen in the British Museum (1936.12.30.173), but I have been unable to see any "tree-like" markings on the scuta, which appear to have a rather narrow, unbranched lucida, running straight from the stalk to the opposite border of the blade, i.e. down the middle of the long axis of the scutum and transverse to the long axis of the zooecium. The zooecia are a little shorter and stouter than those of *S. frondis* and the ovicells are also shorter in proportion to their width and have more numerous pores with raised borders. The frontal avicularia are raised on short columns, those of *S. frondis* being sessile, and the cervicorn spine also differs. In Thornely's specimen its main axis is broad and flattened and the tines are more numerous and shorter than in true *S. frondis*. Finally the vibracular chambers are much larger than those of *S. frondis*, though similar in shape. I therefore regard Thornely's specimen as representing a distinct species.

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[1] Not *S. cervicornis* Busk 1852*a* = *S. diadema* (see Harmer, 1926, p. 375).

[2] Harmer (1926, p. 382) regarded *S. pusilla* as synonymous with *S. spatulata* (d'Orbigny), but as my remarks are based entirely on specimens from the Western Atlantic, the locality studied by Smitt, I have used the name *S. pusilla* in this discussion.

The Tortugas material of *S. frondis* consists of a number of colonies growing together on weed. In most of them the ancestrula, which is evidently joined to the first zooecium by a very fragile connexion, has broken away, but one was found complete (Fig. 18 C), and another ancestrula which had not yet formed a whole daughter-zooecium was growing on the same weed and evidently also belonged to this species (Fig. 18 D). From Ascension Island (St. 1, 16 November 1925) there are two similar ancestrulae, each with two daughter zooecia and the beginning of a third. The ancestrulae are short, with straight or convex sides and an oblique terminal opesia. They have ten spines surrounding the opesia and no scutum. They are slung by two rootlets, one issuing from each proximal corner of the first zooecium, and the second zooecium has a vibraculum which gives rise to another anchoring rootlet. All the zooecia have scuta and the typical number of spines. The number of tines on the branched spine, which is bifid in the first zooecium, gradually increases, and both the proximal spines gradually become more curved over the aperture. The typical arrangement is attained by the end of the second or beginning of the third internode.

Canda Lamouroux, 1816

1. **Canda arachnoides** Lamouroux.

Canda arachnoides Lamouroux, 1816, p. 132; 1821, p. 5, pl. lxiv, figs. 19–22; Busk, 1852*b*, p. 26, pl. xxxiii; 1884, p. 25; Waters, 1887, p. 89; Levinsen, 1909, p. 142; Harmer, 1926, p. 385, text-fig. 17.

not *Canda arachnoides* Waters, 1909, p. 165.

Station distribution. *New Zealand:* Sts. 934, 935.

Geographical distribution. Timor (Lamouroux); Australia (Busk; Waters; Levinsen; Harmer); New Zealand (Waters; Discovery).

I have examined Waters's specimens (kindly lent by the Manchester Museum), and confirmed the Australian and Tasmanian records (1887). The Red Sea specimens (1909) are clearly distinct from *Canda arachnoides* but not readily to be identified with a described species, though agreeing in many ways with *C. caraibica* Levinsen. The specimen from Enoshima, near Yokohama, recorded in the same paper, belongs to *C. pecten* Thornely.

Waters wrongly quoted Philipps's record of *C. retiformis* from Brazil as *C. arach-*

noides. Philipps (1899, p. 441) noted differences between the specimen from Brazil (90.1.30.13), which appears to have been correctly determined as *C. retiformis*, and her specimens from Lifu which have proved to belong to *C. clypeata* and *C. pecten* var. *scutata* (see Harmer, 1926, pp. 387, 389).

Caberea Lamouroux, 1816

Two much-discussed groups of species of *Caberea* are represented in these collections, namely, the *C. darwinii* group and the *C. boryi* group. In *C. darwinii* the outer distal border of the scutum typically meets a little projection from the outer border of the opesia so that the operculum is framed, and there is usually another small condyle-like process at the base of the stalk of the scutum (Fig. 21 A).[1] In *C. boryi* there is a complete calcareous bar across the orifice underlying the distal border of the scutum which is fused to it (Fig. 19 B). The bar has a suture, and it seems probable that it is formed by the fusion of outgrowths equivalent to the condyle-like processes of *C. darwinii*. The presence of a bar is associated with other characters apparently of systematic value, and, although one can imagine the bar being developed secondarily as the zooecium grows older, I have in fact found that it is laid down at a very early stage in the development of the zooecia of those forms in which it is present, and I have seen no tendency to its subsequent development in other forms. I therefore conclude that the presence or absence of a bar is a character of systematic importance.

The *C. darwinii* group as I understand it extends over a wide area, and the characters appear to intergrade in correlation with climatic conditions so that, despite the differences, in size and other characters, of the extreme forms on the fringes of the area, there may only be one species (see pp. 377, 383).

In the *C. boryi* group, on the other hand, I have given reasons for recognizing three species, *C. boryi*, *C. helicina* and *C. zelandica*, whose differences are not correlated with distribution. *C. boryi* has a wide range from the Mediterranean (perhaps England) to Australia; the other two species are known from Australia and New Zealand, and from New Zealand and Juan Fernandez respectively.

A frontal keel is a conspicuous feature of some biserial forms of *Caberea*, and most species are also more or less keeled basally. The frontal keel is formed by the oblique development of the frontal surface of the zooecia, so that they slope away from the mid-line of the branch. The basal keel is formed partly by the convexity of the basal surface of the branch, but chiefly by the projection of the vibracular chambers. The extent to which a branch is keeled, both frontally and basally, is best estimated from a lateral view, as can be seen in Figs. 20 A, B, 21 C, 25 D. In Fig. 25 D, for instance, there is a pronounced basal keel, while the frontal surface, being rather flat, is seen in foreshortened view. In Fig. 20 A the basal keel is less marked, but the frontal surface is so strongly keeled that the opesia and cryptocyst are in almost full view. The frontal keel may be accentuated by the presence of ovicells or large frontal avicularia. These structures project more or less in all four figures, but by comparing the position of the aperture this rather misleading feature is discounted.

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[1] Not always visible in all zooecia, unless suitably cleaned and mounted, and absent in the first-formed zooecia of the colony, and in *C. glabra* MacGillivray which may be a synonym of *C. darwinii*, see p. 381. Not shown in Busk's figures of *C. darwinii* (1884, pl. xxxii, fig. 6), but present in his specimens, see my figures (Figs. 21 A, 22 A–C).

The vibracula consist of a calcareous chamber containing the muscles which move the seta, a calcareous groove in which the seta rests, and, at one side, a small rootlet-chamber. The groove extends beyond the vibracular chamber, and the species differ both in the proportion of the chamber to the groove and in the proportion of the whole vibraculum to the zooecium. In *C. boryi* (Fig. 19 A) the chamber is small, the groove is small and inconspicuous (though it may be longer than in Harmer's figure), and the whole structure is small in proportion to the zooecium, leaving considerable areas of the basal zooecial wall uncovered, even when the rootlet is in position. In *C. helicina* (Fig. 20 A), *C. darwinii* (Fig. 21 C) and *C. rostrata* the chamber is larger than in *C. boryi* and the groove is much more developed, forming a larger proportion of the whole structure. More of the basal surface is thus covered and a more pronounced keel is formed. When the rootlets are present the appearance of a fairly close oblique striation of the basal surface is produced. In *C. zelandica* the chamber forms a rather larger proportion of the whole, and the vibracula lie more closely together (Fig. 20 B). In *C. angusta* and *C. transversa* Harmer (1926, p. 363) the chamber is very long, with the result that no distinction between the chamber and the extension of the groove beyond it is noticeable in the outline of the vibraculum as a whole. The vibracula are larger, and are in close contact throughout their length, covering very nearly the whole of the basal surface of the branch (Fig. 25 D).

As pointed out by Harmer a calcareous bridge is constantly present, crossing the groove near the articulation of the seta. From here nearly to the end of the vibracular chamber the floor of the groove is membranous, so that the calcareous end-wall of the chamber may form another bridge-like structure crossing the groove, as shown in *C. boryi* by Harmer. Where, as in *C. angusta* (Fig. 25 D) and *C. transversa*, the chamber is long and tapering, this second bridge is not noticeable. In *C. zelandica* (Fig. 20 B), on the other hand, the short chamber ends much more abruptly, and the appearance of a second bridge may be very marked.

Key to the species of Caberea *in the collection*

All the species in this key are biserial.

1. Calcareous bar[1] across orifice, with scutum fused to it 2
   No calcareous bar, scutum may be connected to process from opposite border of opesia ... 4
2. Vibracular chambers small, distant from each other. Single frontal avicularia sometimes much enlarged. Marginal avicularia not enlarged... ... ... **1. C. boryi**
   Vibracular chambers[2] large, near together or touching, single very large frontal avicularia not present, some marginal avicularia may be moderately enlarged 3
3. Branches stout, flat frontally, frontal avicularia small, proximal lobe of scutum often reduced ... ... **3. C. zelandica**
   Branches not particularly stout, keeled frontally,[1] many frontal avicularia may be moderately enlarged, proximal lobe of scutum not reduced ... ... **2. C. helicina**

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[1] See p. 365.

[2] See p. 366.

4. Ovicells springing from about half distal border of orifice. Vibracula close together throughout their length ... ... 7. **C. angusta**

Ovicells springing from whole width of distal border of orifice, vibracular chambers usually not touching, grooves in contact 5

5. Scutum with pointed distal lobe, a very prominent giant frontal avicularium below many of the bifurcations, its chamber narrowing to relatively small attachment, mandible considerably longer than wide, other frontal avicularia not enlarged. Cryptocyst narrow and smooth ... ... 8. **C. rostrata**

Scutum with blunt distal lobe, giant frontal avicularia below bifurcation rare,[1] not very prominent, their chamber widening to broad attachment, mandible comparatively short, sometimes many frontal avicularia moderately enlarged, cryptocyst extensive, usually granular ... ... 4. **C. darwinii**

1. **Caberea boryi** (Audouin). Fig. 19 A, B.

Crisia boryi Audouin, 1826, p. 242; Cellaires Savigny, pl. xii, figs. 4^1–4^6.

Caberea boryi Harmer, 1926, p. 362, pl. xxiv, figs. 13–15; Canu and Bassler, 1928, p. 22; 1930, p. 19, pl. ii, figs. 10–12; Hastings, 1932, p. 411; Neviani, 1939, p. 23.

Caberea boryi (part) Busk, 1852*b*, p. 38.

not *Caberea boryi* Busk, 1852*b*, pl. xvi, figs. 4, 5 (=*C. zelandica*).

not *Caberea boryi* Busk, 1852*b*, pl. xxxviii; Busk, 1879, p. 194; Jullien 1888, p. 75; Calvet 1904, p. 7; Waters, 1905*a*, p. 232 (see *C. darwinii*).

not *Caberea boryi* Kirchenpauer, in Studer, 1889, pp. 268, 269 (fide Marcus, see p. 374 below).

not *Caberea boryi* O'Donoghue, 1923, p. 161; 1926, p. 87.

not *Caberea boryi* Hasenbank, 1932, p. 359, text-fig. 28 (=*C. darwinii* var. *occlusa*).

STATION DISTRIBUTION. *New Zealand:* St. 934.

GEOGRAPHICAL DISTRIBUTION. Britain? (Busk; Hincks; Harmer); Roscoff (Waters); Mediterranean (Audouin; Heller; Waters; Canu and Bassler); Atlantic Coast of Morocco (Canu and Bassler); Madeira (Busk); South Africa (Busk; 99.7.1.304); Red Sea (1937.9.28.6); Indian Ocean (Thornely); Amboina; Japan (Harmer); Australia (Busk? Waters; Hastings); New Zealand (Discovery). See Addendum, p. 501.

Harmer (1926) redefined *Caberea boryi*.

Busk, as he himself recognized later (1884, p. 29), at one time confounded several distinct species under *C. boryi*. Neither of his plates in the British Museum Catalogue (1852*b*, pls. xvi, xxxviii) represents true *C. boryi* (see *C. zelandica* and *C. darwinii* below). Of his list of localities, Algoa Bay is confirmed by a specimen (99.7.1.304) in his collection. The specimens from South Devon are not available, but doubtless belonged to the British species, well known as *C. boryi*, whether it is Audouin's species or not (see Harmer, 1926).

The material from Cumberland Island likewise cannot be traced. Harmer accepted Busk's figs. 4 and 5 (pl. xvi) as *C. boryi*, and implied, in his synonymy, that they represented the Cumberland Island specimen. I have shown (p. 373) that they represent *C. zelandica*, and were probably drawn from New Zealand material. It follows that Harmer's conclusion that the Cumberland Island specimen was *C. boryi* was not founded on good evidence, though not improbable on geographical grounds. When

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[1] Found in var. *guntheri*, and in less pronounced form in some Antarctic specimens.

Busk (1884, p. 29) reinstated the various forms that he had in 1852 merged in *C. boryi* (see p. 373), he identified the Cumberland Island specimen with *C. darwinii*, and it thus seems unlikely that it was true *C. boryi*. Its identity must remain uncertain, but it may well have been *C. helicina*, for *C. darwinii* is not at present known from the Queensland coast, whereas *C. helicina* is known from Broughton Island and has hitherto been confused with *C. darwinii*.

The material from Madeira (Busk, 1860, p. 281; 99.7.1.844, 845) is characteristic *C. boryi*, though fragmentary. Specimens from Glenelg (99.5.1.380) and Singapore (99.5.1.376), labelled *C. boryi* in the Hincks collection (see Hincks, 1880, p. 63), are both distinct from true *C. boryi*. The one from Glenelg is pluriserial, somewhat resembling *C. lata*. The material from Singapore is very fragmentary. It is biserial but shows none of the essential characteristics of *C. boryi*. Marcus found that Kirchenpauer's specimens were not true *C. boryi* (see p. 374 below). The identity of *C. boryi* Hutton (1873, p. 91) is also uncertain (see p. 374).

Dr O'Donoghue has kindly lent me material from Vancouver recorded by him (1923, p. 161; 1926, p. 87) as *C. boryi* Audouin. It differs from true *C. boryi* in the complete absence of scutum and oral bar, in the rarity and extremely small size of the frontal avicularia, and in the shape and larger size of the zooecia. It appears to be closely related to *C. ellisii* Fleming, which was also recorded from the Vancouver region by O'Donoghue. The zooecia and ovicells closely resemble those of *C. ellisii* in size, shape, form of cryptocyst, number of spines and absence of scutum. They differ in the small size of the vibracular chambers (a character in which they resemble *C. boryi*), and in the rarity of the frontal avicularia which are extremely small and only present on the median zooecium at the bifurcation. Except for these median zooecia, the specimens are biserial.

A specimen from Puget Sound (Busk Coll. 99.7.1.871), agreeing very closely with O'Donoghue's material, was identified by Busk with *C. ellisii*. One branch is triserial, and a few frontal avicularia are present on other zooecia than the median ones, but they are small and very rare. In other respects, including the small size of the vibracular chambers, the agreement with O'Donoghue's material is very exact. The reference to Hincks under *C. boryi* in O'Donoghue's paper (1923) is a slip. Hincks recorded *C. ellisii*, not *C. boryi*, from Queen Charlotte Island.

Fig. 19 B, drawn from a specimen from Ghardaqa, Red Sea (1937.9.28.6), shows the characteristic relations of the scutum and oral bar. The ancestrula of this specimen is closely similar in size and shape to that of *C. helicina* (Fig. 19 C).

2. **Caberea helicina** sp.n. Figs. 19 C, D, 20 A.

Caberea darwinii MacGillivray, 1886, p. 129; 1887*a*, p. 141, pl. cxxxvii, figs. 1, 1 *a–d*, 5 (not *Caberea darwinii* Busk).

? not *Caberea darwinii* MacGillivray, 1895, p. 25, pl. iii, fig. 10.

STATION DISTRIBUTION. *New Zealand:* St. 934.

GEOGRAPHICAL DISTRIBUTION. Victoria (MacGillivray); Port Phillip, Victoria (87.12.10.20; 97.5.1.235; 35.3.8.1); Sydney (81.10.21.355); Broughton Island (86.12.31.9); Tasmania (1937.6.10.1); New Zealand (Discovery; St. TN 91).

HOLOTYPE. Port Phillip Heads. Bracebridge Wilson Collection, 97.5.1.235.

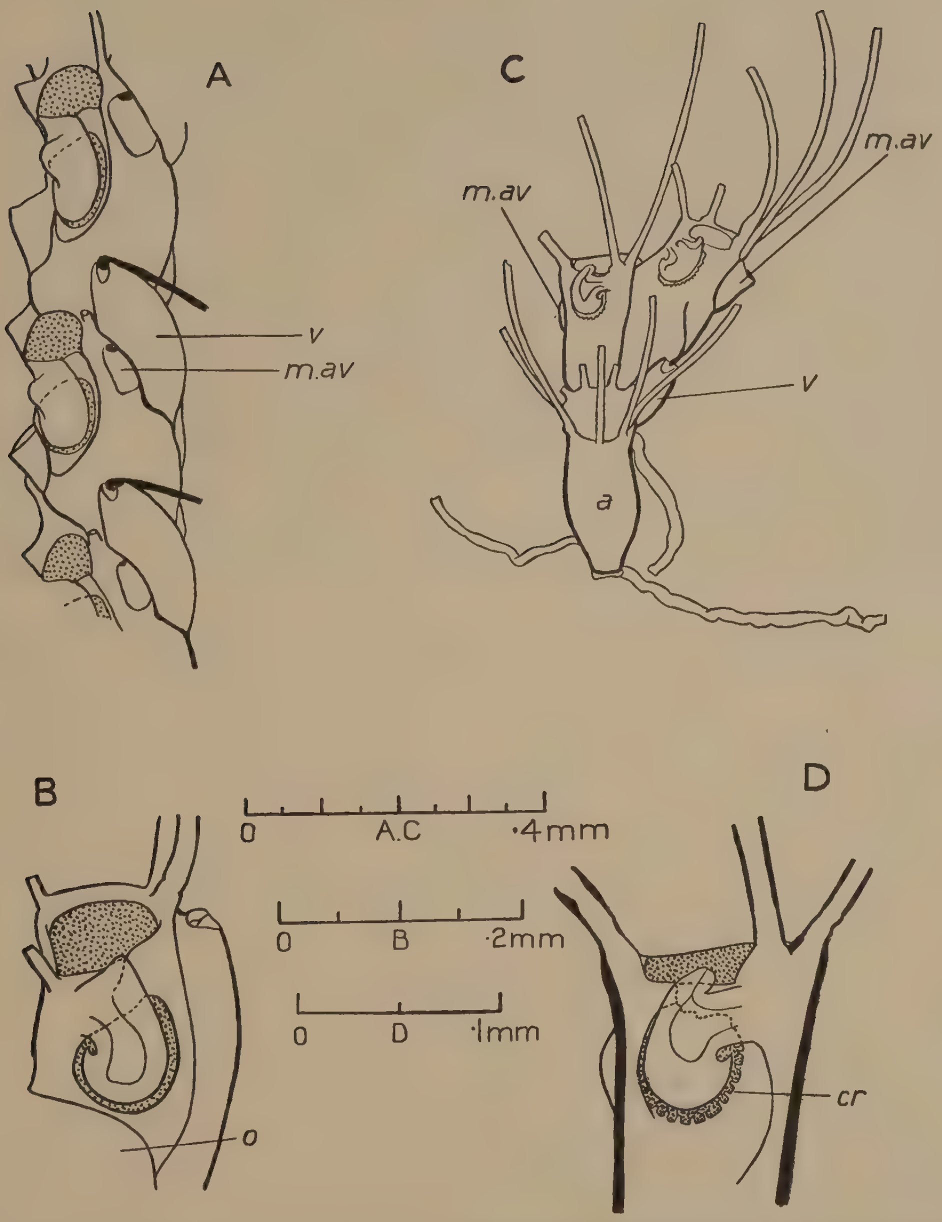

Fig. 19. A. *Caberea boryi* (Aud.). 32.4.20.106. Great Barrier Reef Expedition, St. XII. Vibracular setae cut short. B. *C. boryi* (Aud.). 1937.9.28.6. Ghardaqa, Red Sea. C, D. *C. helicina* sp.n. 35.3.8.1. Port Phillip. C. Young colony with ancestrula. D. Part of the first zooecium from Fig. C more highly magnified.

Transverse bar underlying scutum shown by dotted line. *a.* ancestrula, *cr.* crenulated edge of cryptocyst, *m.av.* marginal avicularium, *o.* ovicell, *v.* vibraculum.

This species, which was very accurately figured by MacGillivray, is distinguished from *Caberea darwinii* Busk by the characters of its scutum and cryptocyst. As in *C. boryi* and *C. zelandica*, and in contrast to *C. darwinii*, there is a thickened, oblique bar across the aperture to which the scutum is fused (Fig. 19 D). The scutum usually has a small pointed distal lobe projecting over the thickened bar and a little point on the proximal lobe, directed towards the stalk, though both may be lost. The proximal lobe fills the opesia. Its lumen becomes narrower than that of *C. darwinii*, and curved, constituting the "helicine mark" of MacGillivray. The cryptocyst is wide proximally and usually granular, and in at least some of the zooecia in every colony has a crenulate border. This border may be distinct in very young zooecia in which the granulation of the surface of the cryptocyst has not yet appeared. On the other hand, it is sometimes not discernible till the specimen has been treated with eau de javelle. Enlargement of many of the frontal avicularia is common in this species, as in *C. darwinii*, and was shown by MacGillivray in his fig. 1. When the branch is seen in profile, these avicularia may give a serrated edge to the frontal keel (Fig. 20 A). Some of the marginal avicularia may also be slightly enlarged. There are usually two outer distal spines and one peduncular spine. A second inner spine, which is also found in some specimens of *C. darwinii*, is frequently present on young zooecia.

In the New Zealand specimens from St. 934 and St. TN 91 the cryptocyst is rather smooth, though wide as in typical specimens. A line of beading is present, but is not always quite at the edge of the cryptocyst, so that it is not very conspicuous in frontal view. A third outer spine is often present and the peduncular spine may be long and stout. The vibracular chamber is rather smaller than usual, but it is not as small as in *C. boryi* and the grooves are long.

Two fragments from St. TN 144, belonging to this group of species, resemble *C. helicina* in their scuta, enlarged frontal avicularia, small marginal avicularia and moderate keel, and have long, stout peduncular spines like the other New Zealand specimens; but the cryptocyst is rather narrow and uniform in width and has a smooth edge. Though small, the colonies are mature, having ovicells and being strongly calcified.

The Tertiary species figured as *C. darwinii* by MacGillivray (1895, pl. iii, fig. 10) seems not to have had a bar across the aperture and is probably something different.

A young colony of *C. helicina* (35.3.8.1), consisting of an ancestrula and two zooecia is shown in Fig. 19 C. The ancestrula is similar in shape to that of *C. darwinii* but smaller, and has only formed one vibraculum. The first zooecium has a strongly crenulated border and a scutum of characteristic shape, but the lumen is rather restricted and does not form a helicine mark, and the oral bar is set transversely to the longitudinal axis of the zooecium, instead of obliquely. Each zooecium has a marginal avicularium.

C. helicina is most nearly related to *C. zelandica*, but well-developed fertile colonies of the two forms show pronounced differences. The branches of *C. zelandica* are flatter frontally and stouter (cf. Fig. 20 A and B). The cryptocyst is very little, if at all, wider proximally, and usually has a smooth edge. Rarely there is a little roughening or beading near the base of the scutum. The frontal avicularia of *C. zelandica* are small, except for the median one at a bifurcation which may be slightly enlarged. The enlarged marginal avicularia are of similar shape in the two species, but are rare and only slightly enlarged in *C. helicina*, whereas in *C. zelandica* they are numerous and may be very large (Fig. 20 D). The proximal lobe of the scutum is usually reduced in *C. zelandica*, though specimens in which some scuta are like those of *C. helicina* in this respect are found (e.g. 99.7.1.884 and 1938.5.2.15). The two small colonies of *C. zelandica* from St. TN 144 show that the first-formed zooecia of the colony also have scuta of this type. The difference in the position of the bridge of the vibraculum which appears in Fig. 20 A, B is not constant.

Marcus (1921*b*, p. 91) regarded the form here identified with *C. zelandica* as the aged state of *C. darwinii* (in which he included *C. helicina*), but the pronounced difference between well-developed, fertile colonies of *C. zelandica* and *C. helicina* shows clearly that the relationship is not an age succession.

Marcus mentioned specimens from South-west Australia, Port Jackson, New Zealand and Carnley Harbour, Auckland Islands, as agreeing very closely with MacGillivray's description. As I have examined the material from Carnley Harbour and do not regard it as belonging to *C. helicina* (see p. 379 below) I have not included any of these records in my statement of the distribution of *C. helicina*.

3. **Caberea zelandica** (Gray). Plate VI, fig. 5; Fig. 20 B–D.

Selbia zelandica Gray, 1843, p. 292.

Caberea boryi (part) Busk, 1852*b*, p. 39, pl. xvi, figs. 4, 5 (*C. zelanica* on plate).

not *Caberea zelanica* Busk, 1852*a*, p. 378 (fide Busk).

Caberea lyallii Busk, 1884, p. 29 (nom.n. for *Selbia zelanica* [sic] Gray).

? *Caberea lyallii* Hutton, 1891, p. 103; Hamilton, 1898, p. 194; Hutton, 1904, p. 295.

? *Caberea boryi* (part) Hutton, 1873, p. 91.

Caberea darwinii (part) Marcus, 1921*b*, pl. v, fig. 1*a* (not *C. darwinii* Busk).

Caberea darwinii Marcus, 1921*a*, p. 96.

STATION DISTRIBUTION. *New Zealand:* St. 929.

GEOGRAPHICAL DISTRIBUTION. *Specimens in British Museum:* Auckland, New Zealand (Sinclair, 33.3.10.1; Busk Coll. as *C. boryi*, 1938.8.12.1); New Zealand (51.7.4.29; 75.1.5.74; 90.5.27.72; 1934.10.24.31, 32; 1938.5.2.15; Busk Coll. as *C. lyallii*, 99.7.1.881, 885; Busk Coll. as *C. lyallii* from B.Mus., 99.7.1.886; Busk Coll. as *C. zelanica* (*boryi*), 99.7.1.6549; Busk Coll. as *C. lyallii* from Lyell, 99.7.1.884, 889; Busk Coll. as *C. boryi* from Lyell, 1938.8.12.2; Busk Coll. as *C. boryi* from Colenso, 99.7.1.6612; Hincks Coll. 99.5.1.385, 391; St. 929, Discovery). Otago, New Zealand (Hincks Coll. 99.5.1.193). Palliser Bay, Wairarapa, New Zealand (90.5.27.74, 76, 100). Challenger St. 167, New Zealand (as *C. rostrata*, 87.12.9.129, and Busk Coll. 99.7.1.891). Cape Maria van Diemen (St. TN 144).

Specimens in other collections: New Zealand, I 88; Auckland, New Zealand, I 90 (slides lent by Dr Marcus). Masatierra, Juan Fernandez Islands, 28.3.1917, SPE 723, 30–45 m. and SPE 390 20–35 m. (Riksmuseum Stockholm 646, 645; also the specimen, I 86, figured by Marcus, 1921, pl. v, fig. 1*a*, lent by Dr Marcus).

DESCRIPTION. *Colony* thick, bushy (Plate VI, fig. 5), branching and joints typical of the genus.

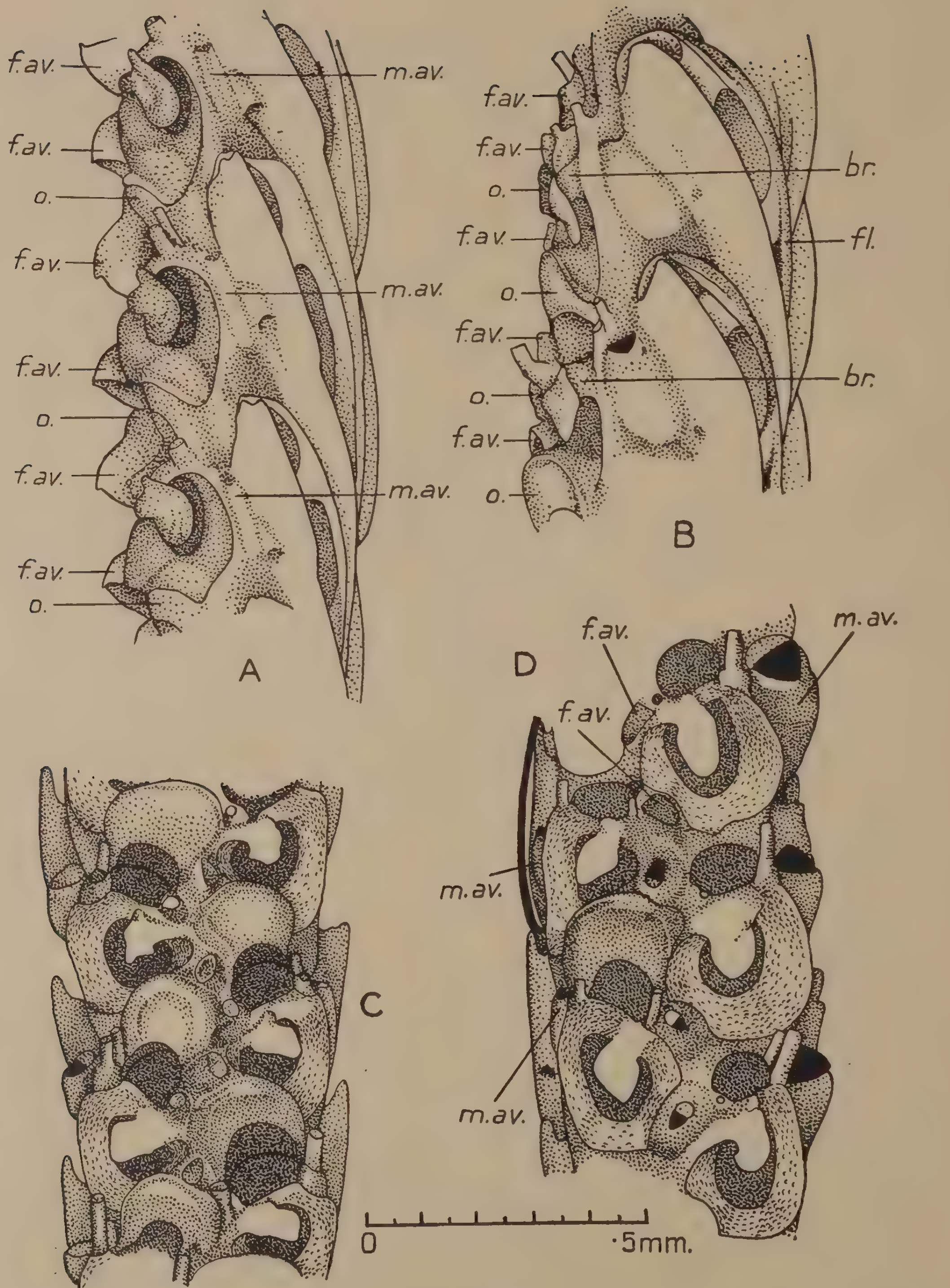
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Fig. 20. A. *Caberea helicina* sp.n. 97.5.1.235. Port Phillip. Fertile branch, cleaned with eau de javelle, side view. Contrast the obliquity of the frontal surface with the flat surface of *C. zelandica*, Fig. B. B, C. *C. zelandica* (Gray). 33.3.10.1. Auckland, New Zealand. B. Fertile branch, side view. C. Frontal view. Many of the spines and avicularia are represented by scars. D. *C. zelandica* (Gray). 99.7.1.889. New Zealand. Branch with enlarged marginal avicularia on one side and small ones on the other.

All drawn from dry specimens seen by reflected light. *br.* bar, *f.av.* frontal avicularium, *fl.* flange, *m.av.* marginal avicularium, *o.* ovicell.

Branches biserial, rather broad and flat.

Zooecia (Fig. 20 C, D) with one or two outer distal spines and one peduncular spine. Cryptocyst little, if at all, wider proximally, granular except in young zooecia, edge usually smooth, rarely a little roughened or beaded near base of scutum. Calcareous bar, across opesia, forming proximal border of orifice.

Scutum fused to bar, distal lobe inconspicuous, proximal lobe of variable size, usually small and appearing as an appendage from bar, sometimes covering opesia and having point towards stalk as in *Caberea helicina* and *C. boryi*.

Operculum well chitinized.

Frontal avicularia small, showing usual reversal of direction on fertile zooecia.

Marginal avicularia with tendency to moderate enlargement, palatal surface sloping obliquely towards frontal surface of branch (Fig. 20 D).

Vibracula (Fig. 20 B) covering large part of basal surface, groove not very long in proportion to chamber, appearance of a second bridge may be marked (cf. p. 366).

Ovicells variable, usually wider than long, with large part of the ectooecium uncalcified.

REMARKS. Gray's description, which was based on material sent from New Zealand by Dr Sinclair, would apply to any biserial *Caberea*, but the only biserial *Caberea* among Sinclair's New Zealand specimens in the British Museum belongs to the present species. It is, however, probably not the specimen described by Gray. Unlike the majority of Sinclair's specimens, it bears no date, but the evidence of labelling, though not conclusive, points to its having been received with a later batch than that described by Gray in 1843. It was not named by Gray, although the other particulars are in his handwriting. There is thus no type-specimen of *C. zelandica*.

Busk used Gray's name (which he spelt *zelanica*) first for a species from Cumberland Island (1852*a*), and later, in the B.M. Catalogue, for the present species which he figured recognizably though not very accurately (1852*b*, pl. xvi, figs. 4, 5). By the time the text of the catalogue was completed he had decided to include both of these in *C. boryi*, as well as a South American *Caberea* which he had called *C. patagonica* on the plate, regarding them as variations due to "age and other circumstances". This was, however, not his final opinion, for in 1884 he reinstated the South American species as *C. darwinii*, introduced a new name, *C. lyallii*, for *C. zelandica* Gray, and pointed out that the supposed *C. zelandica* from Cumberland Island (see p. 367) was distinct from the New Zealand species. Of the specimens included in *C. boryi* in the B.M. Catalogue, only those from Devon and Algoa Bay were left in *C. boryi*, as appears from his statement of the distribution of "the true *C. boryi* of Audouin".

The sentence in which he introduced the name *C. lyallii* makes it quite clear that he believed *C. zelandica* Gray to be represented by a New Zealand species which he had formerly called by Gray's name. This could only be the New Zealand material of the B.M. Catalogue, i.e. the present species. As Busk was working on the British Museum collections when Gray was in charge of them, and only a few years after Gray's work was published, it may be assumed that at the time of writing his B.M. Catalogue he knew which species Gray intended. His figures of *C. zelandica* may thus be taken as representing Gray's species and amplifying the original scanty description. There are inconsistencies in the *Challenger Report*, and I conclude that he reinstated *C. zelandica*, and introduced a new name for it, as an afterthought, without making all the necessary alterations in his manuscript, or relabelling all the specimens in his collection. He apparently thought the new name desirable because he had used Gray's name wrongly for the Cumberland Island specimen, but this is not a valid reason, and *C. lyallii* is a synonym of *C. zelandica*.

My conclusion that the present species is the one that Busk believed to be *C. zelandica* Gray, and for which he unnecessarily introduced the name *C. lyallii*, is supported by a number of his specimens. There is in particular a New Zealand specimen (99.7.1.886) mounted in one of the styles of the B.M. Catalogue collection, and marked as having come from the British Museum, which Busk successively labelled *C. zelanica*, *C. boryi*, *C. lyallii*. It appears not to be the figured specimen for it has no vibracular setae.

Marcus's figure (1921 *b*, pl. v, fig. 1 *a*) of a specimen of what he regarded as the aged state of *C. darwinii* from Juan Fernandez is a characteristic representation of *C. zelandica*. Through the kindness of Dr Marcus and of Dr Bock, I have been able to examine both the figured slide and the unmounted material, and to confirm their very close agreement with *C. zelandica*. Dr Marcus also lent me a specimen of this species from Auckland, New Zealand.

Marcus examined the material from New Zealand recorded as *C. boryi* by Kirchenpauer (1889, pp. 268, 269) and showed that, as one might expect from its abundance, it was not true *C. boryi*. As other New Zealand specimens identified by Marcus with *C. darwinii* have proved to belong to *C. zelandica* it may be that Kirchenpauer's material did also, but it is possible that it belonged to *C. helicina*.

Hutton (1873, p. 91) apparently included more than one species in *C. boryi*, and one had a complete bar. He subsequently adopted the name *lyallii*, as did Hamilton, but without indicating what species was intended.

The relationship of *C. zelandica* and *C. helicina* is discussed on p. 370.

4. Caberea darwinii Busk. Plate VI, figs. 1–3; Figs. 21 A–C, 22 A–C, 23 A–D, 24 A.

Caberea darwinii (part) Busk, 1884, p. 29, pl. xxxii, fig. 6 *c–f* (not fig. 6*a*, *b*, see var. *occlusa*).

Caberea darwinii Waters, 1897, p. 10, pl. i, figs. 13, 21–25; Kluge, 1914, p. 618; Hasenbank, 1932, p. 357, text-fig. 27 A–F.

Caberea darwinii (part) Marcus, 1921 *b*, p. 90.

? *Caberea darwinii* Marcus, 1921 *b*, pl. v, fig. 1.

not *Caberea darwinii* Marcus, 1921 *a*, p. 96; 1921 *b*, pl. v, fig. 1 *a* (=*C. zelandica*).

not *Caberea darwinii* MacGillivray, 1886, p. 129 (=*C. helicina*).

Caberea boryi (part, *patagonica* on plate) Busk, 1852 *b*, p. 38, pl. xxxviii (not *C. boryi* (Audouin)).

Caberea boryi Busk, 1879, p. 194; Calvet, 1904, p. 7; Waters, 1905 *a*, p. 232.

Crisia boryi Jullien, 1888, p. 75, pl. xiii, fig. 5.

Caberea minima Busk, 1884, p. 30, pl. xxxii, fig. 5 *a*, *b*, *d* (not 5 *c*=*Cellaria*).

not *Carbarea minima* Ortmann,[1] 1889, p. 23, pl. i, fig. 9 *a*, *b*.

? *Canda patagonica* d'Orbigny, 1842, pl. ii, figs. 5–9; 1847, p. 9.

? *Caberea glabra* MacGillivray, 1886, p. 129; 1887*a*, p. 142, pl. cxxxvii, figs. 2–4; 1887*b*, p. 200.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. 6, 51, 56, 399, 1321, 1909, WS 82, WS 84, WS 85, WS 86, WS 87, WS 88, WS 95, WS 225, WS 231, WS 243, WS 247, WS 755, WS 847; South Indian Ocean, Sts. 1562, 1563, 1564; *Antarctic:* Weddell Quadrant, Sts. 42, 45, 140, 148, 153, 160, 167, 190, 195, 371, 1948, WS 25, WS 27, WS 33, WS 42, MS 14, MS 64; Victoria Quadrant, Sts. 1660. *New Zealand:* St. 934.

GEOGRAPHICAL DISTRIBUTION. Magellanic Region (Calvet; Waters; Discovery); Patagonian Shelf (Busk; U.S. National Museum; Discovery); New Zealand (Discovery); Auckland Island (Marcus); Tristan da Cunha; Marion Island; Prince Edward Island (Busk; Discovery); Gough Island (Discovery); off South Africa; Possession Island (Busk); Kerguelen (Busk; Hasenbank); Bouvet Island (Hasenbank); South Georgia (Calvet; Discovery; Shackleton-Rowett Expedition); Shag Rocks; South Sandwich Islands; South Orkney Islands; near Elephant Island; South Shetland Islands; Palmer Archipelago (Discovery); Wilhelm II Land (Kluge); Oates Land (Terra Nova); Ross Sea (National Antarctic Expedition; Terra Nova; Discovery).

HOLOTYPE. 99.7.1.855, Straits of Magellan, Darwin, selected here.

A number of forms have been confused with *Caberea darwinii* Busk. Three of these have now been distinguished, namely *C. zelandica* (Gray) and *C. helicina* sp.n., described here, and *C. boryi* (Audouin), redescribed by Harmer (1926). A rather diverse collection still remains, but there is some reason for thinking that most of the variation may be correlated with differences in the climatic conditions in different parts of the wide range of a single species. Before this can be discussed the various forms must be described, and it will also be useful to record the identity and locality of certain figured specimens and to select a holotype.

FIGURED SPECIMENS. With one exception the locality from which the specimens of *Caberea* figured on pl. xxxii of the *Challenger Report* were obtained is noted on the original drawing, and in every case the drawing is accompanied by a sketch of the whole colony (only one of which was published) from which the particular colony figured can be recognized. The information is as follows: figs. 6 *a*, *b*, Challenger St. 142, 87.12.9.132; fig. *c*, Prince Edward Island, Challenger, 87.12.9.135; figs. *d* and *e*, Challenger St. 148, 87.12.9.136; fig. *f*, South Patagonia, Darwin, 99.7.1.856.

SELECTION OF HOLOTYPE. It seems clear, from Busk's introduction of *C. darwinii* as a new name for *C. patagonica* Busk (1852*b*, pl. xxxviii), that a specimen from Darwin's South American material should be selected as the holotype.[2] The choice thus lies between four specimens. Two of these (54.11.15.84, East Falkland Islands and 54.11.15.83, without exact locality) are in the collection deposited in the British Museum by Busk in 1854 (see p. 303). The other two, kept by Busk in his own collection

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[1] Ortmann's figure does not agree with *C. minima* Busk, but neither does it, I consider, with *C. boryi* (cf. Harmer, 1926, p. 362).

[2] Ortmann (1889, p. 23) considered that the material figured as *C. darwinii* by Busk (1884, pl. xxxii, fig. 6) was different from *C. patagonica* Busk (1852, pl. xxxviii), with which he was inclined to merge *C. minima* Busk (1884, pl. xxxii, fig. 5). Reasons are given here for regarding all the material in question as representing one species. In any case the name *C. darwinii*, being an absolute synonym of *C. patagonica*, would not be available for the Challenger material if distinct.

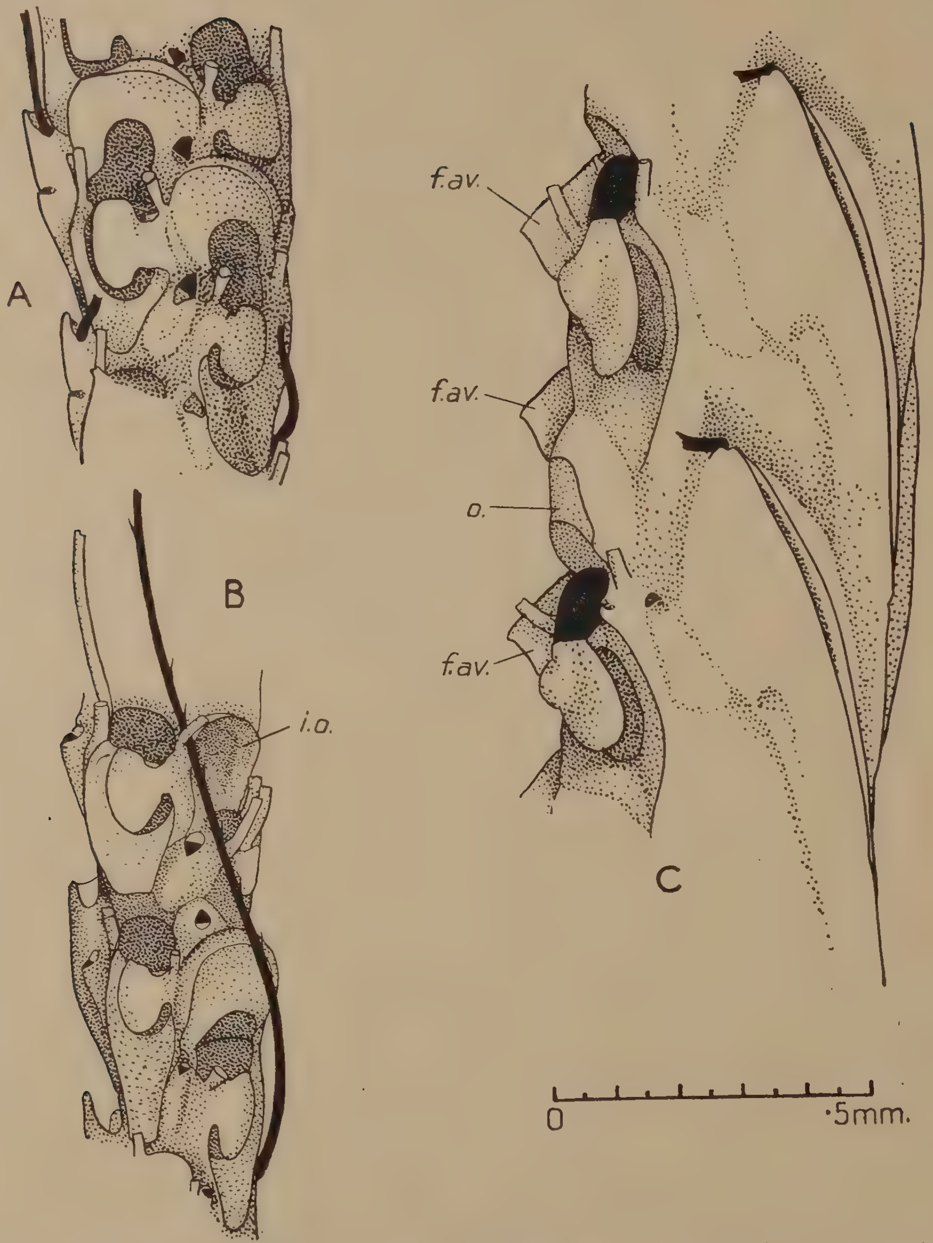

Fig. 21. A–C. *Caberea darwinii* Busk. A. Part of the type-specimen of *C. darwinii*, 99.7.1.855. Straits of Magellan, in slightly oblique frontal view. Vibracular setae curtailed. B. Part of the type-specimen of *Caberea minima* Busk, 87.12.9.144, Challenger St. 315, in slightly oblique frontal view. C. A specimen of antarctic-type, National Antarctic Expedition, McMurdo Sound. Lateral view. Vibracular setae broken. Opercula present.

All drawn from dry specimens seen by reflected light. *f.av.* frontal avicularium, *i.o* incomplete ovicell, *o.* ovicell.

and now in the British Museum, can both be recognized as figured specimens. Of these 99.7.1.855 (Straits of Magellan) is figured (×2, not natural size as stated) in pl. xxxviii, fig. 1 of the B.M. Catalogue. The other, 99.7.1.856 (South Patagonia, 19 fm.) is, as we have seen, the original of Challenger pl. xxxii, fig. 6 *f*. It has not been possible to determine which, if any, of these four specimens were used for figs. 2–7 in the B.M. Catalogue, but as 99.7.1.855 is the original of fig. 1, and is a complete and well-preserved colony, I select it as the holotype.

Description of specimens. The holotype (Fig. 21 A), and other specimens from Darwin's collection represent one of the extremes among the specimens attributed to *C. darwinii*. They are indistinguishable from *C. minima* (Fig. 21 B) which is thus, as has been suggested by various authors (e.g. Marcus, 1921 *a*, p. 96), a synonym of *C. darwinii*. The colonies are small, compact and fan-shaped, branching freely (cf. Plate VI, figs. 1, 2). The branches are rounded or flattened, rather than keeled, frontally. The ovicells are at least as wide as long and are only slightly oblique. There are usually two and occasionally three spines on the outer distal corner (sometimes very close together and hiding each other), one inner spine near the base of the scutum (peduncular spine), and often another inner one placed more distally (Fig. 21 A). The scutum is more or less rounded, its proximal lobe is the longer, but is not particularly long. The cryptocyst may be smooth or slightly granular. The frontal avicularia are not noticeably enlarged. The setal grooves and setae of the vibracula are relatively short.

The other extreme is represented by some of the Antarctic material of the National Antarctic Expedition. The colony consists of long, stout, rather straggling branches. The zooecia are large and long, those of the *minima* type being less than two-thirds the length of the Antarctic ones. The vibracula are large, with long setal grooves and long, stout setae. The zooecia face obliquely away from the mid-line of the branch, giving it a slight keel (Fig. 21 C), which tends to be accentuated by the enlargement of the frontal avicularia, which are placed on this line, and by the ovicells which are usually placed obliquely so that their most prominent portion comes on to the projecting median portion of the branch. The avicularium on the median zooecium at the bifurcation is commonly the largest, though not differing in shape, nor very markedly in size, from the others (Fig. 24 A). The cryptocyst is granular. The scutum has a long proximal lobe. The spines in such specimens are commonly reduced to two, a stout one at the outer distal corner and a peduncular spine near the stalk of the scutum, but the more typical arrangement with two outer and one peduncular spine is also found, and in the figured specimen the small spine distal to the peduncular spine is also present. The larger size of Antarctic specimens of this species was also noticed by Kluge.

Challenger specimens are intermediate between these two extreme types. In the specimen from St. 148, Possession Island, Crozet Group (Plate VI, fig. 3), the branches are moderately keeled (cf. Busk, 1884, fig. 6 *d*), and many of the frontal avicularia are somewhat enlarged (Fig. 22 A). The zooecia and vibracula are large, the ovicells rather oblique and the cryptocyst sharply defined and granular. A single outer distal spine is usual, but there are two on some of the zooecia in the proximal part of the colony, which does not otherwise differ from the other parts.

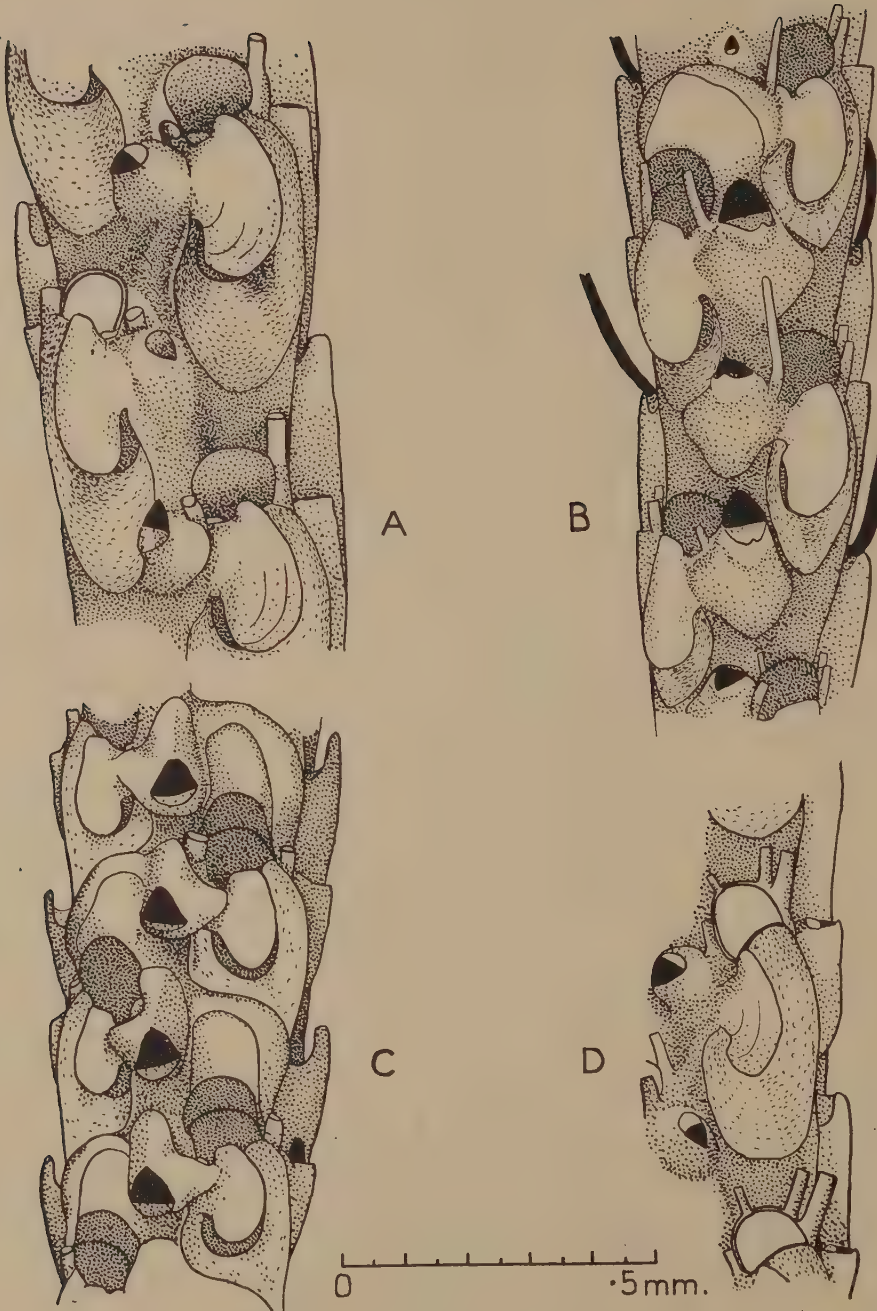

Fig. 22. A–C. *Caberea darwinii* Busk. A. 87.12.9.136. From Challenger St. 148, off Crozet Islands. Very slightly oblique view. B. 87.12.9.133. From Nightingale Island, Challenger Collection, showing enlarged frontal avicularia. C. 99.7.1.850. From Challenger St. 142, off South Africa. D. *C. darwinii* var. *occlusa* var.n. Part of the type-specimen from Challenger St. 142, 87.12.9.132. One zooecium and adjacent structures.

All drawn from dry specimens seen by reflected light.

The specimens from Swain's Bay, Kerguelen (99.7.1.846, 851, 853), recorded by Busk (1879, p. 194) as *C. boryi*, are a little less robust than those from St. 148, the frontal avicularia are less enlarged, and two outer distal spines are more commonly present. The Challenger material from Marion Island (87.12.9.134, 135, 139, 141, 99.7.1.852, 854) and one specimen from Challenger St. 142 (99.7.1.850)[1] resemble those from Swain's Bay (Fig. 22 C). The specimen from St. 142 has particularly large frontal avicularia on the fertile zooecia.

The Challenger specimens from Kerguelen (87.12.9.137, 142, Challenger St. 149) are exceptionally slender. The branches are not keeled, the frontal avicularia are not enlarged, and the vibracula are not quite so large as those of the colony from Possession Island. Two outer distal spines are usual.

The Challenger colonies from Nightingale Island, Tristan da Cunha (87.12.9.133, 99.7.1.847, 849) are intermediate in character between those from Swain's Bay and those of the *minima* type, the branches being of medium length and only slightly keeled and the outer distal spines usually numbering two and sometimes three (Fig. 22 B). The vibracula are a little smaller than those of the Swain's Bay specimens, and many of the frontal avicularia are enlarged. The figures of these specimens given by Waters (1897, pl. i, figs. 13, 25) are inaccurate, particularly in the relationship of the scutum and the orifice, features in which the specimens agree with those from Swain's Bay.

The specimens obtained by the National Antarctic Expedition at their winter quarters in McMurdo Sound, Ross Sea, are all of Antarctic type, but some of those taken by the 'Terra Nova' in the Ross Sea region somewhat approach the Swain's Bay type.

In the Discovery collection the majority of the specimens can be put without hesitation into one of three groups (*minima* type, robust Antarctic type, and intermediate Swain's Bay type) described above. The specimens that cannot readily be placed form two groups, one intermediate between the *minima* and Swain's Bay types, the other between the Swain's Bay and Antarctic types.

SYNONYMY. In view of the ease with which the condyle-like process near the base of the operculum (see p. 365 above) can be overlooked, and considering their locality and their agreement with *C. darwinii* in other respects, I accept Hasenbank's figures of specimens from Bouvet Island as representing *C. darwinii*. The zooecium in Fig. A is as large as those of Antarctic type, but in other respects (e.g. spines and frontal avicularia) is of less extreme character. Fig. F approaches the *minima* type, but resembles *C. glabra* (see p. 381) in the shape of the scutum as well as in the absence of the condyle-like process. The zooecium is, however, larger.

Marcus (1921 *a*) mentioned that the material from Juan Fernandez was of the strongly calcified type, with short, broad zooecia, which he regarded as the aged state of *C. darwinii*. I have shown above (p. 374) that his specimens of this type from both Juan Fernandez and Auckland, New Zealand, belong to *C. zelandica*. His unmounted material from Carnley Harbour, Auckland Island, 6.12.1914 (Marcus, 1921 *b*, p. 91), kindly lent me by the Copenhagen Museum, agrees with typical *C. darwinii* (*minima*

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[1] The other specimens from this station belong to var. *occlusa*, see p. 385

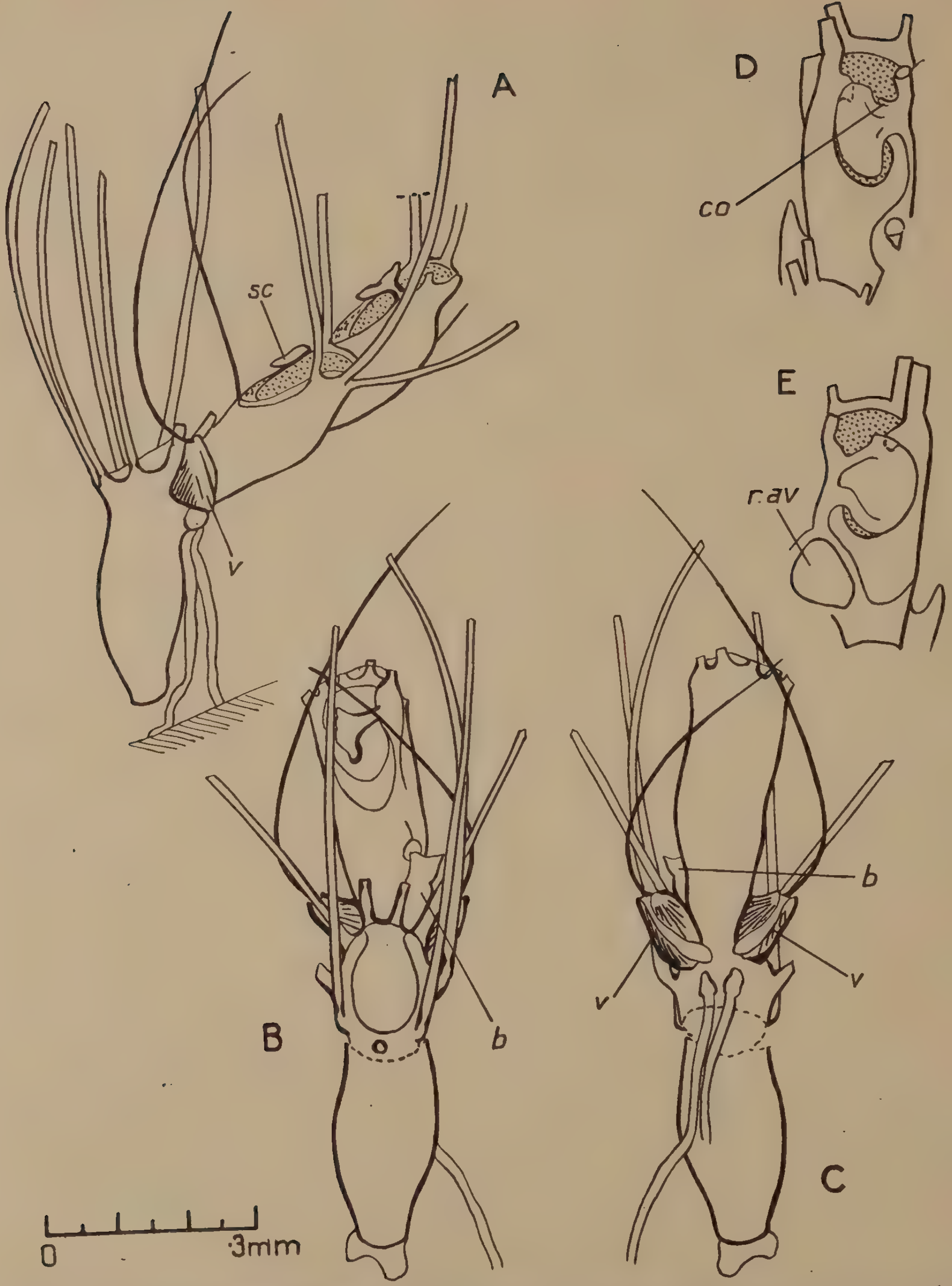

Fig. 23. A–D. *Caberea darwinii* Busk. A. Young colony with ancestrula from St. 1563, Marion Island. Lateral view. B, C. Young colony from St. TN 339, Ross Sea, frontal and basal views. The ancestrula is broken (dotted line) and the colony is flattened (notice the angle between the ancestrula and zooecia in Fig. A). D. Zooecium from a specimen of the *minima* type, from St. 1321, Straits of Magellan. E. *C. glabra* MacGillivray. 99.5.1.378, Port Phillip Heads.

b. bud of second zooecium, *co.* condyle-like process, *r.av.* rudiment of frontal avicularium, *sc.* scutum, *v.* vibraculum.

type). The figured specimen (pl. v, fig. 1) from Auckland Island lent me by Dr Marcus[1] is, however, rather different. Its zooecia are about the same size as those of the *minima* type, but it has a more granular cryptocyst and a scutum with a longer narrower distal lobe and a longer stalk, and, although a small process is present, the scutum is not connected distally with the opposite cryptocyst.

It is unlikely that Stach's record of *C. darwinii* (1937, p. 378) from Lady Julia Percy Island, Bass Strait, was based on true *C. darwinii*.

I have been unable to trace Busk's specimen from Cumberland Island, recorded in the B.M. Catalogue as *C. boryi*, and later (1884) referred to *C. darwinii* (see p. 373 above).

I have examined *C. boryi* Waters (1905*a*) from Cape Horn, kindly lent me by the Manchester Museum, and find that it is a specimen of *C. darwinii* approaching the *minima* type. I agree with Marcus that it may confidently be assumed that both Jullien (1888) and Calvet (1904) had *C. darwinii*. It is clear from Calvet's statement of distribution that he did not distinguish *C. boryi* and *C. darwinii*, and there is no evidence that true *C. boryi* has ever been found in the South American region.

It is hardly necessary to mention that Busk's pl. xxxii, fig. 5*c*, does not represent a *Caberea*. The young *Cellaria* from which it was drawn is still attached to the type-specimen of *Caberea minima*.

C. glabra MacGillivray (Fig. 23 E), whose resemblance to *C. darwinii* was noticed by Marcus (1921*b*, p. 91), remains to be considered, and my material has been insufficient to settle its position. Two typical colonies from Port Phillip (Bracebridge Wilson Coll. 88.11.14.422, 97.5.1.238[2]) closely resemble the *minima* type of *C. darwinii*. The chief distinction lies in the absence, in *C. glabra*, of the little condyle-like process at the base of the stalk of the scutum, to which the operculum articulates in *C. darwinii* (cf. Fig. 23 D, E). As a result, the scutum appears longer-stalked in *C. glabra*, although the stalk is often stouter and the lobes less clearly marked off from it than they are in *C. darwinii*. The distal lobe of the scutum is usually narrower and often pointed and turned a little forwards (i.e. frontally), whereas, in *C. darwinii*, it is broad and blunt, but there is a good deal of variation. No zooecium of typical *C. glabra* has been seen with three outer spines as is sometimes seen in the *minima* type of *C. darwinii*, but the peduncular spine may be long and stout. In both *C. darwinii* and *C. glabra* a small inner spine, distal to the peduncular spine, may be present. The frontal avicularia are on the whole larger in *C. glabra* than in the *minima* type, and the one on the median zooecium at a bifurcation is often the largest, though not greatly enlarged in typical specimens. As in the *minima* type, the cryptocyst may be smooth or granular. The presence of *C. glabra* at South Trinidad Island, off Brazil (Terra Nova Coll.), in latitudes comparable to those of its Australasian localities, suggests that it is a further term in the *darwinii* series (see p. 382), representing the growth of *C. darwinii* in the warmer waters north of the sub-Antarctic region. The presence of the *minima* type of *C. darwinii* at Auckland Island in sub-Antarctic water south of the New Zealand localities of *C. glabra* also supports this idea. The matter is, however, not as simple as this, for small colonies from St. 934, north of New Zealand, appear to represent the *minima* type of *C. darwinii*, some, at least, of the zooecia having a process at the base of the scutum, and three outer spines being found. These colonies have very long, stout, peduncular spines.

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[1] It is mounted on the same slide (I 86) as the figured specimen of *C. zelandica* from Juan Fernandez.

[2] There is also a colony from Port Phillip (Hincks Coll. 99.5.1.378), identified by Hincks with *C. darwinii*, which agrees with the Wilson specimens, and the same characteristics are seen in colonies from Tasmania (99.7.1.888, 34.1.18.4), South Australia (99.7.1.887), Port Phillip (1938.8.2.1, 99.5.1.392), New Zealand (St. 934 and St. TN 144). Stach (1937, p. 378) recorded *C. glabra* from Lady Julia Percy Island in Bass Strait.

The question is further complicated by the existence of specimens from New Zealand and Japan, agreeing in their main characters with *C. glabra*, but diverging in various ways from the typical specimens. The New Zealand material from St. 934 and St. TN 144 is chiefly remarkable for the stoutness of the peduncles of the scuta, but one specimen from each station has giant frontal avicularia, and scuta with a broader, straight-edged distal lobe. The older zooecia of these young colonies have three outer distal spines. Another specimen from New Zealand (Busk Coll. 99.7.1.5014) has giant frontal avicularia which are rather broader and blunter than those of the other specimens. Although connected distally, the scuta have a much smaller blade than those of typical *C. glabra*, with a small blunt proximal lobe and a pointed distal lobe. Specimens from the south coast of Japan (78.1.10.14) resemble Hincks's New Zealand specimen in their giant frontal avicularia, but in other respects agree with typical *C. glabra*.

We have also the form described by MacGillivray (1887*a*, p. 142, pl. cxxxvii, fig. 4) as *C. glabra* var. *dolabrata* in which giant frontal avicularia are not found, the scuta resemble those of Hincks's New Zealand specimen in outline, but are not connected distally, and the peduncular spines are exceptionally long and stout. This form is represented in the British Museum by an unmounted colony from Port Phillip (87.12.10.34), and six slides, coming from Port Phillip (99.7.1.882), Warrnambool (99.5.1.382, 383, "Warnamboul" on labels), Flinders Island (86.25.29.30, 31) and Puebla Bay (88.11.14.379), all in the Victorian region.

Only the examination of more material could determine the relationship of this group of Australasian and Japanese forms (including *C. glabra*) to *C. darwinii* and to each other.

Young colonies of *C. transversa* Harmer (including those from the Barrier Reef, Hastings, 1932, p. 411) are hardly to be distinguished from typical *C. glabra*, although adult colonies are much more robust and differ clearly from adult colonies of *C. glabra* in the shape of scuta and ovicells, and in the larger, more closely placed, vibracula. Bassler's material of *C. transversa* from the Philippines (31.12.30.69) agrees closely with the type in these respects.

Discussion of distribution. It will be noticed that, although *C. darwinii* has several times been recorded from Japanese localities, I have omitted Japan from the distribution. These records are without supporting evidence. Even the diagnosis accompanying Okada's record of a "small specimen" (1934, p. 8) is not a description of the actual specimen but a quotation, almost verbatim, of Busk's definition. The species is typically Antarctic and sub-Antarctic, and has not been recorded from the Malay Archipelago, the China Sea, Northern Australia, or Queensland, so that its occurrence in Japan seems improbable, and I am inclined to await further evidence before accepting it as Japanese. Possibly some of the Japanese records are based on *glabra*-like specimens such as are discussed on p. 382.

The known area of distribution of *C. darwinii* (see p. 375) corresponds very closely to the sub-Antarctic and Antarctic regions of the southern ocean as limited, at the surface, by the subtropical convergence (see Fig. 59, and Deacon, 1933, 1937), though the species extends as far north as South Trinidad and the north of New Zealand (see p. 382).

Table 1. *Summary of distribution of* Caberea darwinii *and* Caberea glabra

The heavy lines A and B mark the positions of the subtropical and Antarctic convergences (see Fig. 59). The localities in the subtropical and sub-Antarctic zones are arranged according to their distance northward from the convergence that constitutes the southern limit of the zone. The Antarctic localities are arranged from north to south according to latitude. New Zealand lies across the subtropical convergence, but the specimens come from the northern part of the islands.

A B

	Subtropical			Sub-Antarctic							Antarctic						
	South Trinidad	Challenger St. 142	New Zealand	Tristan da Cunha	Auckland Island	Patagonian Region	Prince Edward Island	Marion Island	Possession Island	Kerguelen	South Georgia	Bouvet Island	South Sandwich Islands	South Orkney Islands	South Shetland Islands	Palmer Archipelago	Ross Sea
*Caberea glabra**	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Caberea darwinii:																	
Minima type	.	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.
Approaching *minima* type	.	.	.	+	.	+	.	.	.	.	+†	?‡	.	.	.	.	.
Swain's Bay type	.	+	.	+	.	+	+	+	.	+	+	.	+	.	.	.	.
Approaching Antarctic type	.	.	.	.	.	.	.	.	+	.	+	?‡	+	.	.	.	+
Antarctic type	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	+	+

* Also known from Victoria and Tasmania. For discussion of related forms see p. 381.

† Single specimen from shallow water.

‡ Based on Hasenbank's figures, see p. 379.

Table 1 shows the distribution of the different types of colony and a general tendency is at once apparent, the small *minima* type being found to the north, the robust Antarctic type to the south, and the intermediate types forming a roughly graded series in the intermediate regions.[1]

The chief exception appears to be the colony of Swain's Bay type from Challenger St. 142 which is off South Africa and north of the subtropical convergence (35° 4′ S,

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[1] A specimen of Swain's Bay type from near Elephant Island was discovered too late for inclusion in Table 1. As it should come between the South Orkney and South Shetland Islands it extends the range of this type southward.

18° 37′ E, 150 fm. = 275 m.). The nearest Discovery stations at which soundings were taken were St. 102 at 35° 29′ 20″ S, 18° 33′ 40″ E, in 1800 m., and St. 407 from 35° 13′ S, 17° 50½′ E to 34° 57′ S, 17° 48′ E in 2822 m. It is thus evident that Challenger St. 142 must have been on the slope of the continental shelf. Hydrological data are rather scanty, but the 'Discovery' took a series of temperatures at St. 102 which shows a uniform temperature down to 50 m. after which the temperature falls, the maximum fall being between 150 and 200 m. In this connexion it is worth noticing Deacon's reference (1937, p. 57) to a northward-flowing current of sub-Antarctic water at 200 m. in the region of the subtropical convergence south of South Africa. These are mere hints, but they suggest that hydrological conditions off the continental shelf in the South African region may be such as to account for the occurrence there of specimens of *C. darwinii* of more southerly type.

To get a rough idea of the relationship of the whole fauna at Challenger St. 142 the list given by Murray (1895, p. 416) was examined. At that time about 45% of the species were not known elsewhere. Of the remainder, more than a third were also taken at sub-Antarctic stations.

The occurrence of specimens approaching the Antarctic type at Possession Island (Challenger St. 148) may perhaps be related to the greater depth at which they were obtained, the dredgings being made at 210–550 fm. as compared with 20–127 fm. at Kerguelen and 50–150 fm. at Prince Edward Island (Murray, 1895, pp. 439, 458, 475). The relationships of the other Cellularine Polyzoa of these islands are discussed on p. 483.

Where two or more types are found in the same region, there are some indications of a correlation with depth, despite the small range of depth represented (see, for example, Tables 4 and 5, pp. 487, 490, showing the range of depth at South Georgia and in the Patagonian region), but it is very inexact, as might be expected in view of the complicated depth relations of the different types of water.

The smaller zooecia, flat branches, greater number of spines, and less specialized vibracula, scuta and avicularia, are all features of *C. minima* which can be regarded as juvenile, and one does in fact find some gradation in these characters as one passes from the base to the tip of some colonies. I have not, however, found the whole range in any one specimen, and the correlation with geographical distribution is enough to show that it is not simply a case of the gradual assumption of the adult characters as the colony grows. The distribution of certain species of *Amastigia*, discussed on p. 325 is comparable.

ANCESTRULAE. Ancestrulae attributed to *Caberea darwinii* were obtained from Marion Island and Prince Edward Island (Sts. 1562, 1563, 1564, 7. iv. 35, 12 ancestrulae), the Burdwood Bank (St. WS 87, 3. iv. 27, 1 ancestrula), South Georgia (St. 42, 1. iv. 26; St. WS 33, 21. xii. 26; St. WS 42, 7. i. 27, 3 ancestrulae), off Oates Land (St. TN 194, 22. ii. 11, 2 ancestrulae), Ross Sea (St. TN 339, 24. i. 12, 1 ancestrula), and McMurdo Sound (National Antarctic Expedition, 28. ii. 02, 2 ancestrulae).

The ancestrula is vase-shaped, with spines all round the obliquely terminal opesia and the colony is slung by rootlets (Fig. 23 A–C). The first two, or more, zooecia have more than the typical number of spines, and no frontal avicularia. Scuta, with a well-developed distal lobe, are present on them, and neither the projection from the outer margin of the opesia nor that at the base of the stalk of the scutum is present. The cryptocyst is narrow and the vibracula small. On succeeding zooecia, frontal avicularia appear, the spines decrease in number, the cryptocyst becomes wider proximally and more granular, the scutum becomes blunter distally and meets a lobe from the opposite edge of the opesia, and the vibracula increase in size, until the typical adult characteristics are attained.

From Marion Island there are several young colonies which have not advanced far enough to show the characteristics of the species but agree so closely with the corresponding parts of the more advanced colonies that they are identified with fair certainty. The young colony from St. TN 339 (Ross Sea), shown in Fig. 23 B, C, is similar. In it the ancestrula was lightly attached by a membranous vesicle as well as by a pair of rootlets springing from the bases of the two first zooecia. The vesicle evidently represents the primary attachment by which the ancestrula was fixed before the rootlets developed, and no doubt other ancestrulae, now slung by rootlets, were originally attached in the same way. In some of them the remains of the vesicle can be seen.

A few ancestrulae which have not yet given rise to a whole zooecium have also been identified with *C. darwinii* on the strength of their agreement in shape, and the presence of less dubious specimens from the same stations. It is interesting to see that the first pair of rootlets, and the vibracula belonging to the first two zooecia, may be fully formed while the buds of the zooecia are still at a very rudimentary stage. On the other hand, one of the specimens with a fully formed first zooecium has only one vibraculum.

The fifteen ancestrulae from Marion Island, Prince Edward Island and South Georgia range in length from 0·34 to 0·42 mm., the average being 0·37 mm. The four ancestrulae from the Ross Sea region are larger, ranging in length from 0·42 to 0·50 mm., average 0·46 mm., which suggests that the ancestrulae, like the other zooecia, are larger in the Antarctic. This might perhaps be expected, but more Antarctic ancestrulae would be needed before it could be regarded as established.

5. **Caberea darwinii var. occlusa var.n.** Fig. 22 D.

Caberea darwinii (part) Busk, 1884, p. 29, pl. xxxii, fig. 6*a*, *b*.

Caberea boryi Hasenbank, 1932, p. 359, text-fig. 28.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. South Africa (Busk; Hasenbank).

HOLOTYPE. Challenger St. 142, 35° 4′ S, 18° 37′ E, 150 fm., 87.12.9.132.

One colony from Challenger St. 142 has already been described among the specimens of *C. darwinii* (p. 379), but two others (87.12.9.132, 138) appear to represent a distinct variety. In them the cryptocyst on the outer distal side of the opesia is expanded in such a way that three-quarters of the proximal border of the operculum is in contact with the distal edge of the cryptocyst, the remaining quarter being connected with the small process from the other side of the opesia and with the very narrow distal lobe of the scutum (Fig. 22 D). The inner distal spine is rather constantly present.

As in many specimens of *C. darwinii*, there are many moderately enlarged frontal avicularia.

Hasenbank's figure shows all these peculiarities and clearly represents this variety. He recorded *C. boryi* from four South African stations, and he has kindly informed me that the figured specimen came from St. 114, which was in Simon's Bay at 70 m. Challenger St. 142, on the other hand, was on the edge of the continental shelf (see p. 384).

Although this variety shows some resemblance to *C. boryi*, I am satisfied that its affinities are with *C. darwinii*. It differs from *C. boryi* in its extensive, granular cryptocyst, in the absence of an oral bar, in the large vibracula which almost completely cover the basal surface, in the absence of giant frontal avicularia and the presence of many moderately enlarged ones. In all these respects it resembles *C. darwinii*, particularly specimens of the Swain's Bay type. In the part played by the cryptocyst of the outer side of the opesia in the formation of the proximal lip of the orifice, it far exceeds *C. boryi*, and in this respect it is distinct from both *C. boryi* and *C. darwinii*. In *C. boryi* the outer cryptocyst forms less than half the lip and widens towards the orifice to do so (see Fig. 19 B and Harmer, 1926, pl. xxiv, fig. 13). In var. *occlusa* the cryptocyst forms fully three-fourths of the lip, although it is little, if at all, wider in that part. The variation of typical *C. darwinii* shows that size may be of little systematic significance, but it should be mentioned that the zooecia of var. *occlusa* are larger than those of *C. boryi* (cf. Figs. 19 A and 22 D in which the difference in size is quite marked despite the greater magnification of the drawing of *C. boryi*).

The original drawing of fig. 6*b* in the *Challenger Report* is accompanied by a sketch of the whole colony (reproduced in the *Report* as fig. 6*a*) which can be recognized as representing the colony now made the type of var. *occlusa*. This indication of the identity of the specimen figured by Busk is confirmed by the fact that the actual branch shown in fig. 6*b* can be recognized from the accuracy with which certain details are drawn. Despite this, the drawing of the scutum and cryptocyst is inaccurate and shows none of their peculiarities. My Fig. 22 D is drawn from the same specimen.

6. **Caberea darwinii var. guntheri var.n.** Plate VI, fig. 4; Fig. 24 B.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. WS 840, WS 871.

GEOGRAPHICAL DISTRIBUTION. Off Patagonian Shelf, below 336 m. (Discovery).

HOLOTYPE. St. WS 840.

These specimens differ from typical *C. darwinii* in the presence of gigantic avicularia, placed proximally to many of the bifurcations, the other frontal avicularia being small (Fig. 24 B). The gigantic avicularia have a broad mandible, and the avicularian chamber spreads proximally over the peduncles of the scuta of neighbouring zooecia, forming lobes of which the more proximal is usually long and pointed. The extensive cryptocyst is finely and evenly granular as seen in dry specimens, but may appear almost smooth in a balsam preparation.

In the relatively luxuriant growth of the colonies (Plate VI, fig. 4), in the large size of the zooecia and vibracula, in the number of spines, and in the keeled frontal surface of the fertile branches, this variety resembles the Antarctic form of *C. darwinii*. It differs in the small size of all the frontal avicularia except those on the median zooecia at the bifurcations, and in the large size and characteristic shape of these median avicularia. In the Antarctic form the avicularium on the median zooecium may be larger than the other frontal avicularia, but all are more or less enlarged and of similar shape so that there is not the marked contrast that is found in this variety (cf. Fig. 24 A, B).

Coming from the region of the Falkland Islands and showing so many of the characteristics of the Antarctic type var. *guntheri* seems at first sight to disagree with the distribution of *C. darwinii* as summarized on p. 383. The stations at which the variety replaced the typical form are, however, the deepest from which Polyzoa were obtained in the Patagonian region, and there is some reason to think that they are influenced by Antarctic conditions (see p. 486).

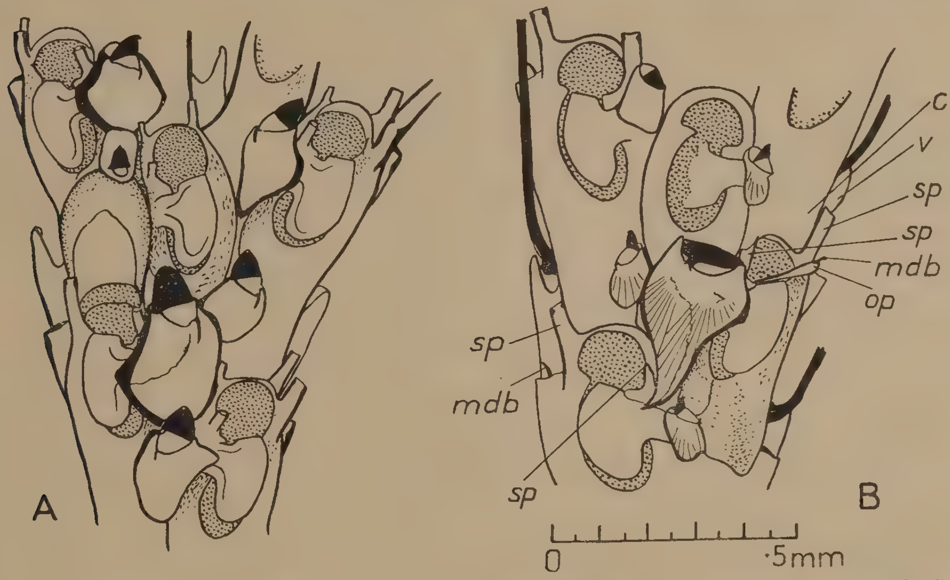

Fig. 24. A. *Caberea darwinii* Busk, Antarctic type. National Antarctic Expedition, McMurdo Sound. B. *C. darwinii* var. *guntheri* var.n. St. WS 840, between Burdwood Bank and Patagonian Shelf. Both drawings show the zooecia immediately preceding a bifurcation. In Fig. B the scutum of the median zooecium is broken, and the granulation of the cryptocyst has been omitted from all but one of the zooecia.

c. cryptocyst, *mdb.* mandible, *op.* operculum (open), *sp.* spine, *v.* vibraculum.

The form from Juan Fernandez figured by Marcus (1921*a*, p. 98, text-fig. 1*a*) as *C. rostrata* (see p. 390 below) also has a giant avicularium before the bifurcation, with the chamber spreading proximally, but with a longer mandible, and no pointed prolongation of the chamber. Spines are more numerous than in var. *guntheri*, and the zooecia are smaller and have a smooth cryptocyst with no marked proximal widening. The scuta are similar in shape and have a distal connexion, as in *C. darwinii*, but the condyle-like

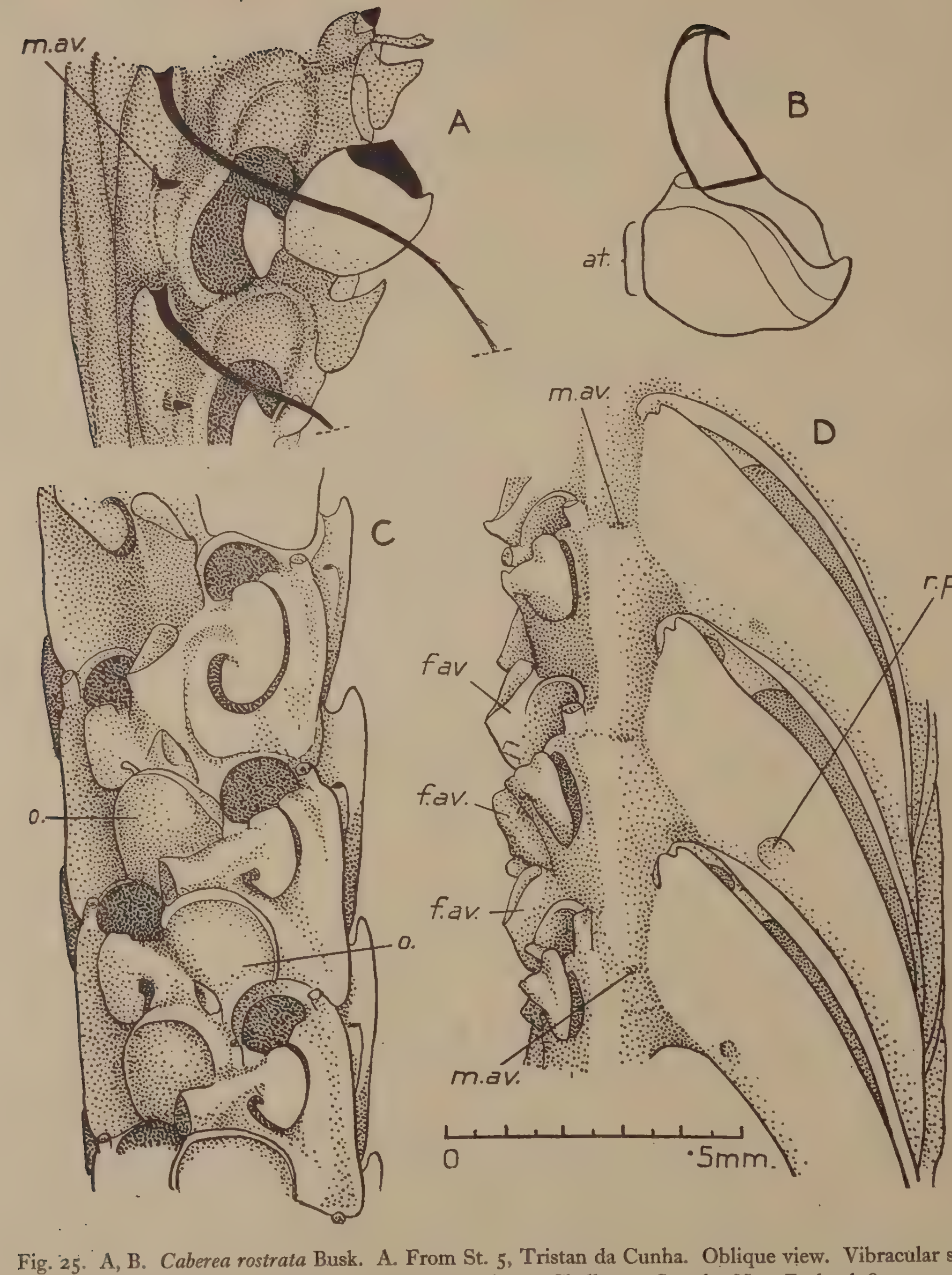

Fig. 25. A, B. *Caberea rostrata* Busk. A. From St. 5, Tristan da Cunha. Oblique view. Vibracular setae curtailed. B. Large avicularium from type-specimen, Challenger St. 167, New Zealand, 87.12.9.128. C, D. *C. angusta* sp.n. St. 935, New Zealand. C. Slightly oblique frontal view showing ovicells. D. Lateral view, without ovicells.

All drawn from dry specimens seen by reflected light. *a.t.* area of attachment of avicularium, *f.av.* frontal avicularium, *m.av.* marginal avicularium, *o.* ovicell, *r.p.* rootlet-pore.

process at the base of the stalk, which is well developed in var. *guntheri*, is absent in the Juan Fernandez species.

7. **Caberea angusta** sp.n. Fig. 25 C, D.

Station distribution. *New Zealand:* Sts. 934, 935.

Geographical distribution. New Zealand (Discovery).

Holotype. St. 935.

Description. *Colony* with branching and joints typical of genus. Rootlets calcified.

Branches rather stout, biserial, strongly keeled basally, rather broad and flat frontally (Fig. 25 D).

Zooecia usually with two distal spines (one outer, one peduncular), peduncular spine frequently hidden by or fused to frontal avicularium (Fig. 25 C). Aperture occupying whole frontal surface (no frontal gymnocyst). Cryptocyst wide, extra wide proximally when proximal zooecium fertile. No apertural bar.

Scutum meeting stout hooked process from opposite border of aperture. Distal lobe blunt, proximal lobe covering aperture, with a point towards stalk.

Frontal avicularia small and directed distally when distal to an ovicell, otherwise moderately large, with long mandible directed obliquely backwards.

Marginal avicularia very small (Fig. 25 D).

Vibracula large, oblique and in close contact with each other.

Ovicells small, narrow, springing from little more than half distal border of orifice of fertile zooecium, leaving about two-thirds of width of cryptocyst of distal zooecium uncovered between ovicell and margin of the branch (Fig. 25 C).

Remarks. *C. angusta* differs from all other species of *Caberea* known to me in its narrow ovicells which spring from about half the distal border of the orifice and occupy the middle of the branch. In other ways it may be compared with *C. darwinii* which it resembles in its wide cryptocyst and the connexion of the scutum with the cryptocyst. It differs in the large size of the vibracula in proportion to the zooecia, the vibracula being larger than those of the Antarctic type of *C. darwinii*, the zooecia rather shorter than those of the Swain's Bay type, but broad. It follows that the vibracula have to lie more obliquely, are in close juxtaposition, and form a pronounced keel (cf. Figs. 21 C and 25 D). The frontal surface, on the other hand, is flat. The frontal avicularia have a longer narrower mandible, and, in the absence of ovicells, form an almost continuous zigzag series down the middle of the branch. The point on the proximal lobe of the scutum also distinguishes *C. angusta* from *C. darwinii*.

8. **Caberea rostrata** Busk. Fig. 25 A, B.

Caberea rostrata Busk, 1884, p. 28, pl. xxxii, fig. 4 *a–d*; Livingstone, 1929, p. 54.

not *Caberea rostrata* Marcus, 1921 *a*, p. 95, text-fig. 1 *a*, *b*.

not *Caberea rostrata* Waters, 1887, p. 90.

Station distribution. *Sub-Antarctic:* South Atlantic Ocean, Sts. 4, 5, 1187.

Geographical distribution. New Zealand (Busk; Livingstone; Terra Nova); Tristan da Cunha (Discovery).

The type specimen of this species is a complete, mounted colony (87.12.9.128), and agrees well with Busk's description and figures, as do some fragments (99.7.1.892 Busk Coll.) from the same station. A large colony in spirit and some mounted pieces (87.12.9.129 and 99.7.1.891 respectively) also from Challenger St. 167 were labelled by Busk as *Caberea rostrata*, but they are characteristic specimens of *C. zelandica*.

The specimens from Tristan agree very closely with the type. The only differences detected are the slightly greater length of the pointed distal lobe of many of the scuta (Fig. 25 A), and the somewhat shorter mandible and correspondingly less prominent cell of the giant avicularia (cf. Fig. 25 A and B).

A specimen from New Zealand (St. TN 134), which otherwise resembles the type, has a little projection from the outer distal corner of the opesia which sometimes meets the scutum.

One of two young colonies from St. 1187 (Tristan, 18 November 1933) has developed far enough to show that it belongs to *C. rostrata*, and there are several young colonies from New Zealand (St. TN 134, 31 August 1911). The ancestrula and first zooecia are hardly to be distinguished from those of *C. darwinii*. Frontal avicularia appear sooner and are more conspicuous than in *C. darwinii*, and the scuta differ in shape. In *C. rostrata* the scuta on the first zooecia are less unlike those typical of the species and the transition to the normal form is completed by about the fifth zooecium.

The form recorded by Marcus as *C. rostrata* differs from Busk's species, see below.

The specimen from La Perouse, Sydney, attributed by Waters (1887) to *C. rostrata*, has been lent to me by the Manchester Museum. It has no giant avicularia, and the vibracula have a rather small chamber, leaving a great part of the basal surface of the zooecia uncovered. The groove is short and does not extend beyond the chamber. The setae are unfortunately all missing. The few complete scuta resemble those of *C. rostrata* in general shape but are a little larger, and the cryptocyst is narrow as in that species, but the specimen is clearly distinct from *C. rostrata*.

9. Caberea sp.

Caberea rostrata Marcus, 1921*a*, p. 95, text-fig. 1 *a*, *b* (not *C. rostrata* Busk).

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Juan Fernandez (Marcus).

Professor Marcus has kindly lent me a slide of the material from Juan Fernandez recorded by him (1921*a*, p. 95) as *Caberea rostrata*, and I have also examined the unmounted material for which I am indebted to the Riksmuseum, Stockholm. It differs from typical *C. rostrata* in the shape of its giant frontal avicularia in which the chamber expands proximally, spreading over the base of the scutum of the neighbouring zooecium; in the scutum which has a larger blade with both the distal, and the proximal lobes rounded; and in having a slightly wider cryptocyst. The first two points are clearly shown in Marcus's figure, but the cryptocyst, as Prof. Marcus has himself pointed out to me, was not very accurately represented by his artist. I regard Marcus's form as distinct from *C. rostrata*. Comparison with *C. darwinii* (see p. 387 above) shows that it is also distinct from the forms of that species known to me.

Synnotum Pieper, 1881

1. **Synnotum aegyptiacum** (Audouin).

Loricaria aegyptiaca Audouin, 1826, p. 243; Savigny, pl. xiii, figs. 4^1–4^5.

Synnotum aegyptiacum Harmer, 1926, p. 398, pl. xxvii, figs. 3, 4 (synonymy); Hastings, 1930, p. 702; 1932, p. 408; Marcus, 1937, p. 58, pl. xii, fig. 28 A, B; 1938*a*, p. 26, pl. v, fig. 12.

Synnotum aviculare Neviani, 1939, p. 20.

STATION DISTRIBUTION. *New Zealand:* St. 934.

GEOGRAPHICAL DISTRIBUTION. Mediterranean (Pieper; Hincks; Waters; Calvet; Neviani); Red Sea (Waters); South Africa (Waters); Indian Ocean (Thornely; Robertson); Malay Archipelago (Harmer); Australia (MacGillivray; Waters; Hastings); New Zealand (Discovery); Japan (Ortmann); California (Robertson); Gorgona (Hastings); Curaçao; Tortugas (Osburn); Fernando Noronha (Kirkpatrick); Brazil (Marcus).

This species is represented by three small fragments only. They are, however, characteristic and prove that the species is, as might be expected, present in New Zealand waters.

Farciminellum Harmer, 1926

1. **Farciminellum antarcticum** sp.n. Plate VIII; Figs. 26 B, 27 B.

Farciminaria simplex Livingstone, 1928, p. 24.

not *Farciminaria simplex* MacGillivray 1886*a*, p. 130, pl. i, fig. 1.

? *Farciminaria simplex* Kluge, 1914, p. 650, pl. xxviii, fig. 7; Harmer, 1926, p. 405.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, Sts. 27, 42, 140, 144, 172, 175, 366, 1952, WS 42, Victoria Quadrant, Sts. 1652, 1660.

GEOGRAPHICAL DISTRIBUTION. South Georgia; South Sandwich Islands; South Shetland Islands (Discovery); Adelie Land (Livingstone); Wilhelm II Land? (Kluge); Oates Land (Terra Nova); Ross Sea (Terra Nova; Discovery).

HOLOTYPE. Australian Antarctic Expedition, St. 4, 65° 48′ S, 137° 32′ E, 230 fm. 30.2.24.1.

The Antarctic species, *Farciminaria simplex* Livingstone, differs in various ways from *F. simplex* MacGillivray, as noted by Harmer and Livingstone. I propose for it the name *Farciminellum antarcticum*. A specimen from the Australian Antarctic Expedition sent to me by Mr Livingstone agrees exactly with the Discovery and Terra Nova specimens, and I have made it the holotype.

F. antarcticum differs from *Farciminaria simplex* MacGillivray in its tendency to form flat pluriserial branches; in the greater length and slighter calcification of its zooecia; in the absence of the crenulation of the borders of the aperture; and in the presence of thin projecting edges to the aperture of the fertile zooecia (Fig. 26 B). The greatest difference is in the ovicells (cf. Fig. 26 A and B). In general appearance they are narrower and more prominent than those of *F. simplex*, and rather straight-sided. The ectooecium, which is continuous with the frontal membrane of the distal zooecium, is partly calcified, the calcareous portion forming a pair of plates or valves wrapping round the entooecium laterally and frontally. The valves meet in a median longitudinal suture which may form a slight keel. With light pressure the ovicell splits along this line as can be seen in one instance in Fig. 26 B. The entooecium may show a faint radial striation (Fig. 27 B).

The ovicell of *F. simplex* MacGillivray is immersed in a kenozooecium. The frontal wall of the kenozooecium, which forms the ectooecium, is wholly uncalcified and collapses into wrinkles on drying (Fig. 26 A), the space between the entooecium and the walls of the kenozooecium then forming the "depression" mentioned by MacGillivray. A longitudinal wrinkle may sometimes give the impression of a keel, but the ovicell is not keeled.

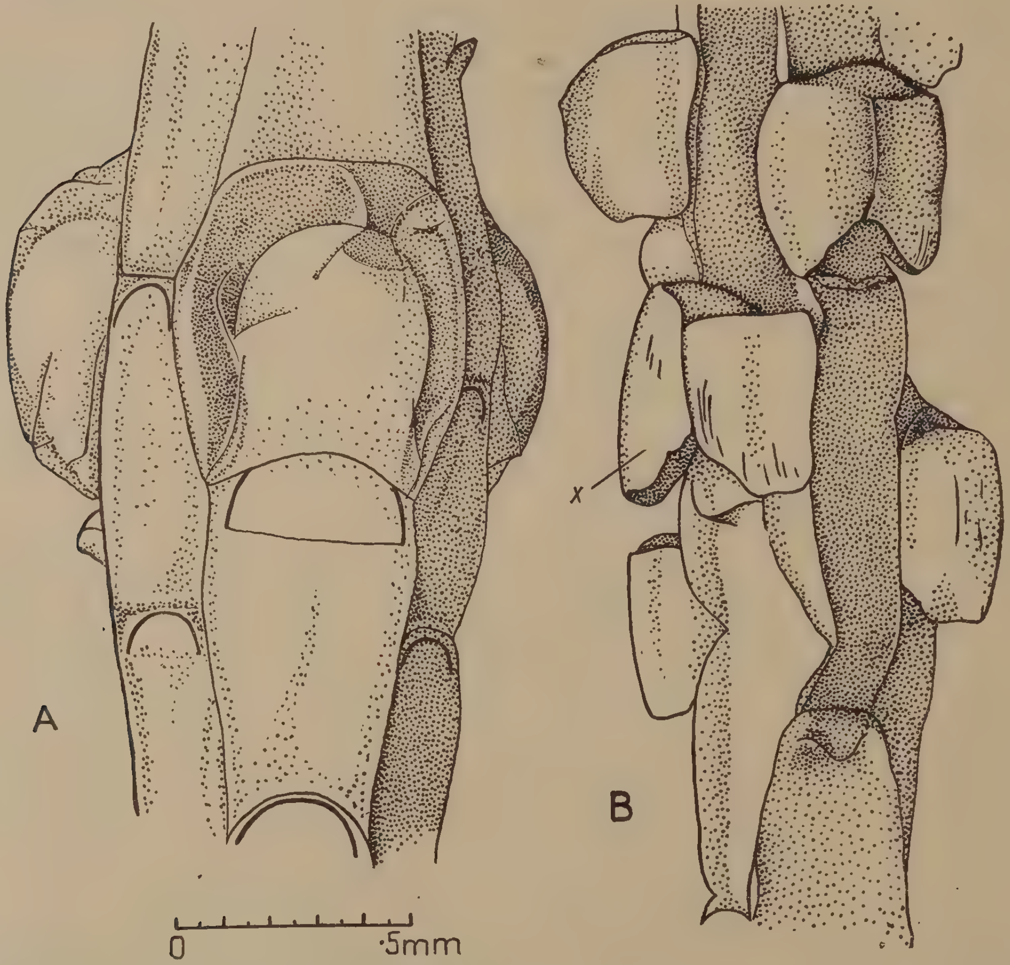

Fig. 26. A. *Farciminaria simplex* MacGillivray. 97.5.1.467. Port Phillip Heads. B. *Farciminellum antarcticum* sp.n. 30.2.24.1. Australian Antarctic Expedition, St. 4, off Adelie Land.

Both drawn from dry specimens seen by reflected light. *X.* slightly crushed ovicell showing splitting along median line.

This species has hitherto been known from more or less fragmentary material. The present specimens show that the colonies attain a considerable size. The material from St. TN 338 comprises six clumps. Plate VIII shows one of the smallest, the largest being 22 cm. long and profusely branched. The proximal branches are enveloped in a thick mass of rootlets so that the colonies appear to originate in a branching stalk.

The figured branch (Fig. 26 B) has four series of zooecia, but flattened, strap-like branches of varying width are more common. The broadest seen came from St. 1952 and had ten series of zooecia on each face. Both layers are formed of autozooecia. The absence of a layer of kenozooecia, and the structure of the ovicells may ultimately separate this species from *Farciminellum*.

Kluge (1914) introduced the name *Farciminaria simplex* independently. As pointed out by Livingstone, Kluge's species agrees with the present species in its zoaria, zooecia and locality. Unfortunately, its ovicells are unknown but it seems probable that *F. simplex* Kluge is a synonym of *Farciminellum antarcticum*.

2. **Farciminellum hexagonum** (Busk).

Farciminaria hexagona Busk, 1884, p. 51, pl. xiv, fig. 10, pl. xxxi, figs. 3–3*b*.

Farciminellum hexagonum Harmer, 1926, p. 405, pl. xviii, figs. 8–10, text-fig. 20 B (synonymy).

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Marion Island (Busk); Andaman Islands (Thornely); Malay Archipelago, 1224–3112 m. (Harmer).

3. **Farciminellum lineare** (Kluge).

Flustra linearis Kluge, 1914, p. 657, text-fig. 37.

Farciminellum lineare Harmer, 1926, p. 405.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Southern Ocean, 2910 m. (Kluge).

I have seen no specimen of this species.

Levinsenella Harmer, 1926

1. **Levinsenella magna** (Busk).

Farciminaria magna Busk, 1884, p. 49, pl. v, fig. 1; Kluge, 1914, p. 650, pl. xxviii, fig. 8.

Levinsenella magna Harmer, 1926, p. 402 (synonymy); Hasenbank, 1932, p. 343.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Off East Africa, 1668 m. (Hasenbank); off Montevideo, 3477 and 4850 m. (Busk); Southern Ocean, 3065 m. and 3397 m. (Busk; Kluge).

I have compared Kluge's description with the type specimens and find that they correspond very closely. Busk's figures were drawn from the specimen from St. 325. The calcareous ribs described by Kluge are a conspicuous feature of the older zooecia. In the oldest zooecia at the base of the colony the whole aperture including the orifice is filled with coarsely granular longitudinal calcareous ridges. The rootlets from this part of the colony are also calcified.

As evidence that var. *armata* Busk is indistinguishable from the typical form Harmer mentioned the presence of single avicularia in two mounted specimens. They are quite numerous in parts of the unmounted colony (87.12.9.230) from which the two slides examined by Harmer were made.

The newly formed ovicells have a radially striated entooecium covered by a membranous ectooecium continuous with the frontal membrane of the distal zooecium. In older ovicells the entooecium is somewhat roughened, and calcareous plates, similar to those described in *Levinsenella borealis* by Levinsen (1909, p. 116, pl. i, fig. 12a–c, *cr*), form under the ovicell and curve round the distal part of the entooecium. In the specimen from St. 153 the ovicells are much flatter (narrower from frontal to basal surface) than in the type specimen from St. 325, and the calcareous plates meet in the mid-basal line. In the more convex ovicells from St. 325 the calcareous plates are only slightly developed and form a narrow strip at each side. There were no ovicells in Kluge's material.

Kenella Levinsen, 1909

1. **Kenella biseriata** (Busk).

Flustra biseriata Busk, 1884, p. 54, pl. xvi, fig. 1; Waters, 1896, p. 290, pl. viii, figs. 6–9, 22.
Kenella biseriata Levinsen, 1909, p. 124; Harmer, 1926, p. 249.

Station distribution. Not represented in the Discovery collections.

Geographical distribution. Off Valparaiso, 3953 m.; Malay Archipelago, 1509 m. (Busk).

This species shows marked resemblances to members of the Farciminariidae and I have therefore included the genus *Kenella*, of which *K. biseriata* is the genotype, in that family.

The curious lateral tubes described by Waters are the hydrothecae of a hydroid. Capt. A. K. Totton tells me that it is a species of *Reticularia*, probably *R. serpens*.

KEY TO THE GENERA OF BICELLARIELLIDAE DISCUSSED HERE

Definitions of these genera (except *Klugella* and *Erymophora* genn.n.) are given by Harmer (1926).

1.	Zoarium branching biserial or pluriserial	2
	Zoarium uniserial and branching, or laminate and not branching	9
2.	Colony flustrine with short marginal kenozooecia	**Klugella**
	Colony cellularine without marginal kenozooecia	3
3.	Colony stalked	4
	Colony unstalked except in so far as rootlets surrounding proximal zooecia form a cable ...	5
4.	Stalk a cylindrical membranous peduncle with rootlets at tip, axillary zooecium (*E*) at bifurcation passing into branch of opposite side from that on which it originates	**Kinetoskias**
	Stalk composed of a series of kenozooecia, axillary zooecium (*E*) at bifurcation passing into branch of side on which it originates	**Caulibugula**
5.	Zoarium biserial. Zooecia divided into two or three sections by folds,[1] turbinate with relatively short opesia	6
	Zoarium biserial or pluriserial. Zooecia not divided into sections, not turbinate. Opesia relatively long...	7

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[1] These folds or nicks in the walls of the zooecia are sometimes called joints, but are quite distinct not only from the highly developed joints of many of the Scrupocellariidae but also from the flexible joint-like zones developed in a few of the Bicellariellidae, e.g. *Bugula mollis* Harmer (1926, p. 445).

6. Avicularia of typical bird's-head form. Zooecia in three sections ... ... **Bicellariella**
Avicularia not of bird's-head form (often columnar or trumpet-shaped). Zooecia in two sections ... ... **Cornucopina**

7. Zooecia not forked proximally, connecting-process at bifurcation forming an axillary chamber, some at least, of the avicularia[1] with very long stalks ... ... **Camptoplites**
Zooecia forked proximally, no axillary chambers formed, avicularia not long-stalked 8

8. Avicularia[1] of bird's-head form. Operculum without distinct rim ... ... **Bugula**
Avicularia[1] not of bird's-head form. Operculum with distinct chitinous rim ... **Himantozoum**

9. Zoarium uniserial with longitudinal connecting tubes at bifurcation ... **Erymophora**
Zoarium laminate and fenestrate, the zooecia connected by four or six radiating tubes; or uniserial without longitudinal connecting tubes ... ... **Beania**

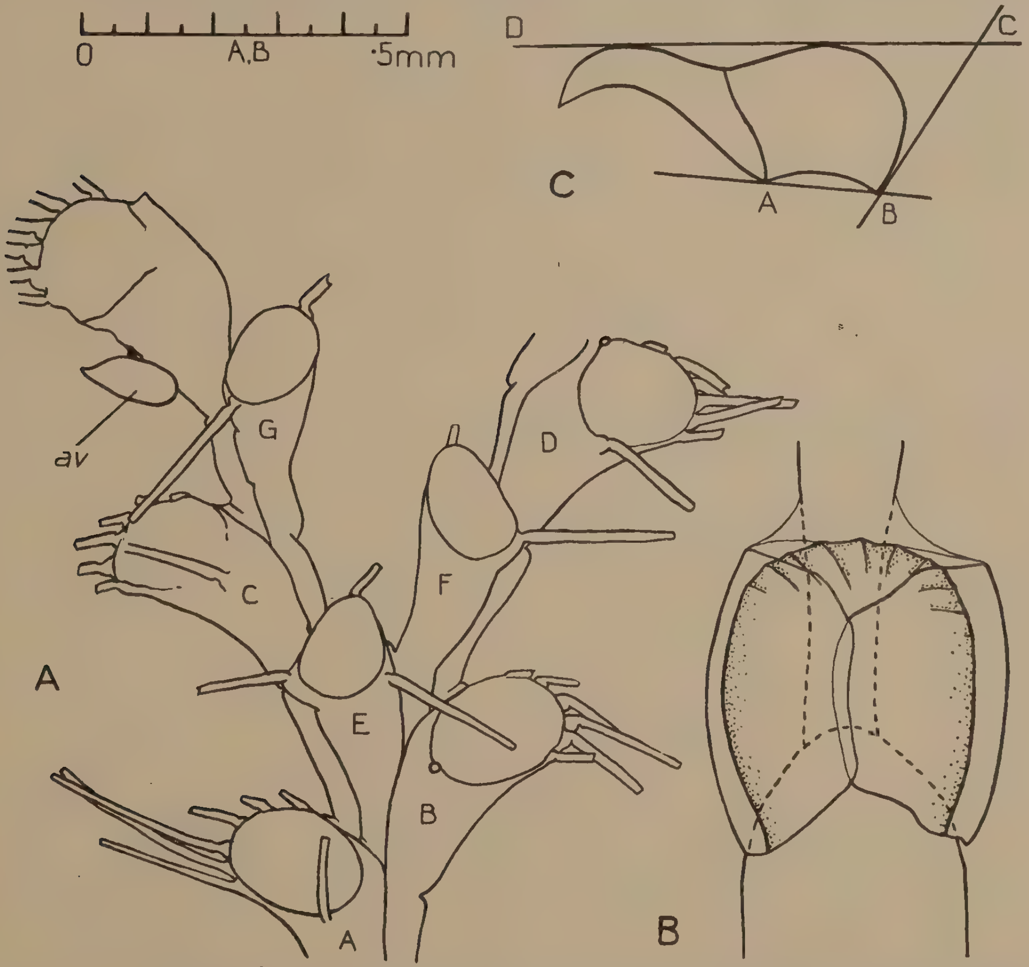

Fig. 27. A, *Bicellariella* sp. St. WS 776, Patagonian Shelf. Zooecia at bifurcation lettered according to Harmer's scheme. B. *Farciminellum antarcticum* sp.n. St. WS 42, South Georgia. Ovicell. C. Diagram to illustrate upper and lower head-angles of avicularia.
av. avicularium.

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[1] Avicularia are absent in a few species, e.g. *Camptoplites atlanticus*, *Bugula neritina*, *Bugula longissima* and *Himantozoum antarcticum*.

AVICULARIAN ANGLES. I have previously (Hastings, 1939, p. 332, text-figs. 275 B, C; p. 336, text-figs. 276 B, C) used Kluge's method of comparing the shapes of the heads of stalked avicularia by means of their upper and lower head-angles, but a definition of the terms may be useful here. In Fig. 27 C the lines *AB*, *BC*, *CD* form the upper and lower head-angles (*BCD* and *ABC* respectively) of the avicularia, as these terms are used by Kluge. It will be seen that the direction of *AB* is determined by the positions of two structural points (*A* and *B*), that *BC* is the tangent at *B* to the curve of the head, and that *CD* is the tangent common to the curves of the top of the head and the top of the beak. Where the tops of the head and beak form one continuous curve, with no intervening concave or flat portion, only the lower head-angle can be defined.

Bicellariella Levinsen, 1909

1. Bicellariella sp. Fig. 27 A.

STATION DISTRIBUTION. *Sub-Antarctic:* Sub-Antarctic Ocean, St. WS 776.

GEOGRAPHICAL DISTRIBUTION. Patagonian Shelf (Discovery).

A single fragment of a species of *Bicellariella* from St. WS 776 is worth recording, as the genus is not otherwise known from the Falkland region.

In the shape of its rather long zooecia, the large size of its avicularia, and their position on the third, or distal, section of the zooecium, it may be compared to *B. capensis* (O'Donoghue, 1924, p. 32) which is probably synonymous with *B. chuakensis* (Waters, 1913, p. 467, see Harmer, 1926, p. 421 footnote). Its spines are more numerous than those of *B. chuakensis*; most zooecia having six in the distal series, and one being constantly present on the proximal border of the opesia (Fig. 27 A). The symmetrical, median, zooecium, *E*, at the bifurcation has three spines, one median distal, and one on each side of the proximal end of the opesia, turning outwards. The axillary zooecia *F* and *G* are smaller than the rest and have only two spines, one distal and one proximal. The bifurcation is of the type described by Harmer (1926, p. 421) in *B. levinseni*. The avicularium has a smooth beak, unlike that of *B. chuakensis* in which it is serrated (Waters, pl. lxviii, fig. 7).

Cornucopina Levinsen, 1909

Key to the species of Cornucopina *discussed here*

1.	Long, straight, flexibly attached, trumpet-shaped avicularia present	2
	Avicularia all relatively short and either rigidly attached or curved	6
2.	Outer distal corner extended forming a spine-bearing process	9. **C. moluccensis**
	No spine-bearing process	3
3.	Ovicells borne on small adventitious zooecia	4
	No special ovicell-bearing zooecia	5
4.	Ovicells reduced. Stalked basal avicularia[1] gigantic and rare	4. **C. polymorpha**
	Ovicells not reduced. Stalked basal avicularia small and common	3. **C. infundibulata**

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[1] For description of stalked basal avicularium see p. 399. It is to be distinguished from the straight trumpet-shaped type.

5. Projecting part of zooecium narrow proximally, with a long tubular part and short opesia, ovicells very shallow, trumpet-shaped avicularia without bulbous swelling proximally ... ... **2. C. conica**

Projecting part of zooecium broad proximally, with opesia occupying nearly its whole length, ovicells well rounded, trumpet-shaped, avicularia with bulbous swelling proximally ... **1. C. pectogemma**

6. Outer distal corner forming a spine-bearing process 7

No spine-bearing process 8

7. Spines fairly evenly distributed on spine-bearing process, opesia angular and extending towards base of daughter-zooecium, cryptocyst present ... ... **10. C. angulata**

Two or three spines at tip of spine-bearing process and two others unevenly spaced along it, opesia oval, not extending towards daughter-zooecium, cryptocyst absent ... **11. C. rotundata**

8. Cryptocyst present, avicularia attached rigidly 9

Cryptocyst absent, avicularia attached flexibly ... ... **5. C. lata**

9. Aperture oval, turned almost at right angles to axis of branch ... ... **6. C. ovalis**

Aperture more or less triangular, not turned from axis ... ... **8. C. zelandica**

1. Cornucopina pectogemma (Goldstein). Figs. 28 C, 32 C.

Bicellaria pectogemma Goldstein, 1882, p. 42, pl. i, figs. 2, 2 A; Busk, 1884, p. 33, pl. vii, fig. 1; Kluge, 1914, p. 637.

Cornucopina pectogemma Harmer, 1926, p. 422; Hasenbank, 1932, p. 338, text-fig. 12 A–D.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, St. 6. *Antarctic:* Weddell Quadrant, Sts. 42, 175, 363, WS 27, WS 33, WS 42.

GEOGRAPHICAL DISTRIBUTION. Tristan da Cunha (Discovery); Marion Island (Goldstein); Prince Edward Island; Heard Island (Busk); Bouvet Island (Hasenbank); South Georgia; South Sandwich Islands; South Shetland Islands (Discovery); Wilhelm II Land (Kluge); Oates Land; Ross Sea (Terra Nova).

Kluge and Hasenbank both refer to the widening of the tube of the trumpet-shaped avicularium near its base (Hasenbank, text-fig. 12 C). This little bulbous swelling is constantly present in my specimens and in the type. A transverse septum is usually to be seen near the base of the bulb (Fig. 32 C). Hasenbank (text-fig. 13 A, D) showed a similar swelling at the base of an avicularium of *Cornucopina moluccensis*, but it is only occasionally present in that species, the constant feature being the eminence (Fig. 32 A) to which the avicularium is attached, which is absent in *C. pectogemma*.

The avicularia vary considerably within the colony, both in length and in size of head, but some colonies consistently show certain peculiarities. The avicularia are stouter and rather shorter, on the average, in that from the South Shetland Islands (St. 175); and conspicuously long and slender, though often large-headed, in the specimen from Tristan (St. 6). The specimen from the South Shetlands has shorter zooecia than most, with the distal part less divergent from the axis of the branch, but similar zooecia are also to be seen in one of the specimens from South Georgia (St. WS

27) whose avicularia have the more typical wide range of size. This South Georgian specimen has unusually numerous spines. In other colonies the maximum number is six (two close together on the outer corner of the zooecium, then three spread along the back, and one near the axis), but in the colony from St. WS 27 there are commonly six along the back, making a total of nine, fairly evenly spaced, spines. Other specimens from South Georgia have the typical number of spines, and zooecia of average length. Although a certain amount of variability is thus to be observed, the variation in the different structures does not seem to be correlated so as to present distinct forms.

Osburn (1940, p. 1) described *C. antillea* from 732 m. in the West Indian region. He noted that it differs from *C. pectogemma* in the form of the trumpet-shaped avicularia, in the presence of avicularia of a second type, in the number and distribution of the spines, and in the ovicells. As no mention is made of the bulbous swelling on the avicularium, this is presumably absent and constitutes a further difference. On the other hand the variation in the spines and trumpet-shaped avicularia in my material of *C. pectogemma* suggest that the differences in these structures may not be important. In particular some of the avicularia of the material from Tristan appear to be very similar to Osburn's. In the absence of figures, I am not clear what constitutes the difference in the ovicells. *C. antillea* thus seems to be chiefly distinguished by the presence of a second type of avicularium, by the absence of the bulbous swelling and by some undefined difference in the ovicells.

Two young colonies of *C. pectogemma* with ancestrulae were taken off Oates Land (St. TN 194). There are no avicularia but the more distal zooecia are otherwise characteristic. The proximal ones have more numerous spines, and differ from the corresponding members of the young colonies of *C. polymorpha* more in size than in shape. The ancestrulae have a small basal bulb which in the older specimen has formed a rootlet. The rest of the ancestrula is separated from the bulb by a joint, and consists of a very long and slender tube and an expanded part bearing the opesia and eleven or twelve evenly spaced spines. One rootlet has run down the back of the older colony and its swollen tip lies beside the bulb of the ancestrula which it somewhat resembles.

These ancestrulae differ from those of *C. polymorpha* described on p. 400 in their very much smaller bulbs and in the much longer tubular part (cf. Fig. 28 A and C). The septum, noticed in *C. polymorpha*, is indistinct but probably present. The shape of the bulb appears to be related to the substratum. The younger specimen (Fig. 28 C) is moulded to the lateral wall of a zooecium of *Himantozoum antarcticum* and is irregular in shape. The older one was found unattached. Its shape is more regularly oval.

2. **Cornucopina conica** Harmer.

Cornucopina conica Harmer, 1926, p. 428, pl. xxix, figs. 1–3.

Station distribution. Not represented in the Discovery collections.

Geographical distribution. Malay Archipelago, 924 m. and 1158 m.; off Crozet Islands, 2928 m. (Harmer).

3. Cornucopina infundibulata (Busk). Fig. 28 B.

Bicellaria infundibulata (part) Busk, 1884, p. 33, pl. vi, figs. 2, 2 *a–d*.

Cornucopina infundibulata Levinsen, 1909, pl. iv, fig. 4 *a–d*; Harmer, 1923, p. 306; 1926, p. 429.

Station distribution. Not represented in the Discovery collections.

Geographical distribution. South Indian and Southern Oceans, 2516–3614 m. (Busk).

A specimen in the British Museum (90.4.14.4) comes from Challenger St. 146, a station from which no Polyzoa were described by Busk although their presence in the trawl is mentioned by Murray (1895, p. 448). Harmer discusses the relationship of this species to *C. polymorpha* and *C. conica* (see below, under *C. polymorpha*).

4. Cornucopina polymorpha (Kluge). Plate VII, fig. 3; Fig. 28 A, D.

Bicellaria polymorpha Kluge, 1914, p. 638, pl. xxx, fig. 1.

Cornucopina polymorpha Harmer, 1926, p. 422.

? *Bicellaria dubitata* Calvet, 1909, p. 5, pl. i, figs. 1, 2.

? *Cornucopina dubitata* Harmer, 1926, p. 422.

Station distribution. *Antarctic:* Weddell Quadrant, Sts. 148, 175, 181, 190, 366, WS 27, WS 33; Victoria Quadrant, Sts. 1652, 1658, 1660.

Geographical distribution. South Georgia (Discovery; Shackleton-Rowett Expedition); South Sandwich Islands; South Shetland Islands; Palmer Archipelago (Discovery); Bellingshausen Sea ? (Calvet); Wilhelm II Land (Kluge); Oates Land; Ross Sea (Terra Nova; Discovery).

Among the small branches at his disposal Kluge did not find any which possessed gonozooecia together with both kinds of avicularia. His composite figure showing all these structures on a single branch is justified by the more abundant material collected by the 'Discovery'.

A few specimens have a third type of avicularium (Fig. 28 D). These, like the trumpet-shaped avicularia, are attached to the basal surface of the zooecia distally and near the middle of the branch. They are as long as the zooecia, or longer, and consist of a slender stalk, and a sharply demarcated head, which is about twice the length of the stalk. The beak is curved. The mandible is nearly as long as the head and is acutely pointed. In shape and position these avicularia resemble the basal ones of *Cornucopina infundibulata* but they are very much bigger (cf. Fig. 28 B and D), the beak is more hooked, and the stalk is more sharply marked off.

In most of the specimens in which this stalked type of avicularium was found the trumpet-shaped avicularia are exceptionally long, their length ranging from 2·2 to 4 mm., in contrast to the more typical 1–2 mm., but in the material from St. 1660 the stalked avicularia were found on branches some of whose trumpet-shaped avicularia measured as little as 1·2 mm. Other specimens with stalked avicularia came from St. 148 (South Georgia) and St. 366 (South Sandwich Islands). The longest trumpet-shaped avicularia were found in the colony from the Palmer Archipelago (St. 181).

C. infundibulata and *C. polymorpha* both have long trumpet-shaped avicularia attached to the basal surface more or less in line with the spines, but nearer the axis of the branch, and stalked basal avicularia placed close to the axis of the branch. The stalked avicularia are small and common in *C. infundibulata*, gigantic and rare in *C. polymorpha*. In addition, *C. polymorpha* has the small curved frontal avicularia figured by Kluge. Harmer's comparison (1926, p. 429) is misleading because, the stalked avicularia of *C. polymorpha* not being known at the time, he contrasted the positions of the stalked avicularia of *C. infundibulata* and the frontal ones of *C. polymorpha*.

As can be seen from Plate VII, fig. 3, *C. polymorpha* grows luxuriantly. The photographed colony, which is the larger of two from the same station, is 13 cm. long, and when held up by the roots forms a mass more or less circular in transverse section and 7 cm. in diameter. Both these colonies terminate basally in a tangle of rootlets, with small stones and grit.

A complete young colony of *Cornucopina* found among the material of *C. polymorpha* from St. 175 (Bransfield Strait, 2 March 1927) has neither avicularia nor ovicells, but agrees well with that species in the shape of its zooecia, and in the number of spines on the more distal ones, those formed first having, as usual, more numerous spines. The colony was attached by a bulbous base fitting into the axil of the forked Cyclostomatous Polyzoan on which it was growing (Fig. 28 A). One end of the bulb is cut off by a curved, transverse septum. A bifurcate rootlet springs from this end of the bulb, and a short, rather thick-walled projection, originating just above the rootlet, gives rise to a long tube, expanding to a zooecial chamber, and separated from the projection by a joint like that separating the tubular and proximal parts of the other zooecia (cf. Harmer, 1926, p. 423). The tubular part of the ancestrula has a ring of thickening in its wall suggesting the beginning of another transverse septum. The expanded distal part resembles that of the other zooecia in shape, but has nine spines, evenly spaced in an obliquely transverse row. Successive zooecia have fewer spines, though they continue to be evenly spaced; and although the colony consists of forty zooecia it is only near the tips of the branches that the distinction between an outer group of spines and a single one near the middle line appears. Five zooecia have produced rootlets which, running down the basal surface and encircling the first zooecium, anchor the colony. A second young colony from the same station consists of a bulb and one zooecium only. These agree exactly with those already described, except that the zooecium has only eight spines.

The form described by Calvet from Biscoe Bay[1] as *C. dubitata* resembles *C. polymorpha* and *C. infundibulata* in having special ovicell-bearing zooecia, and in the presence of both trumpet-shaped and stalked basal avicularia. In the large size of the stalked ones, it resembles *C. polymorpha*, which is also the more probable geographically. Calvet suspected that his material had been decalcified in preservation, and one finds that decalcified specimens of *C. polymorpha* very closely resemble his figure. This might also account for the inflated appearance of the ovicell, which seems less reduced than that of *C. polymorpha*, though smaller than the well-developed hyperstomial ovicell of *C. infundibulata*.

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[1] This must be in the neighbourhood of Biscoe Island, off Graham Land, which was the region visited by the expedition, not Biscoe Bay, King Edward VII Land.

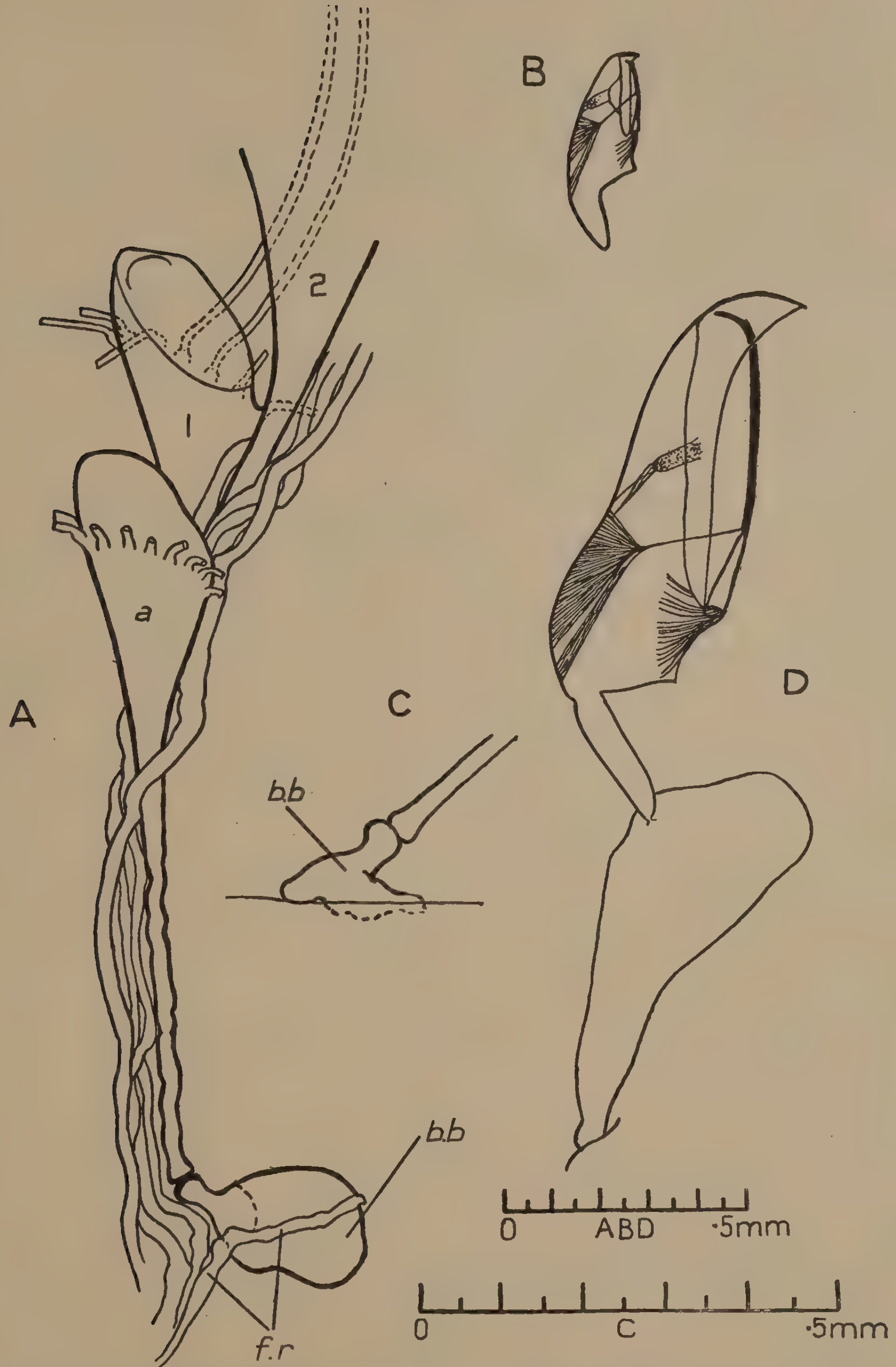

Fig. 28. A. *Cornucopina polymorpha* (Kluge). St. 175, South Shetland Islands. Ancestrula and first zooecium. B. *C. infundibulata* (Busk). Avicularium from Challenger St. 147, off Crozet Islands, 34.2.16.18. C. *C. pectogemma* (Goldstein). St. TN 194, off Oates Land. Basal bulb of ancestrula. D. *C. polymorpha* (Kluge). St. 181, Palmer Archipelago. Stalked basal avicularium with outline of zooecium to which it is attached.

a. ancestrula, *b.b.* basal bulb, *f.r.* forked rootlet originating from the basal bulb, 1–2, first two zooecia.

5. Cornucopina lata (Kluge).

Bicellaria lata Kluge, 1914, p. 639, pl. xxxiii, fig. 1.
Cornucopina lata Harmer, 1926, p. 422.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Wilhelm II Land (Kluge); Oates Land (Terra Nova).

In the Terra Nova material the broad tubular part of the projecting portion of the zooecium, between the main axis of the branch and the proximal border of the opesia, is usually longer than in Kluge's figure. In all other respects the agreement is very exact. The material is fragmentary.

6. Cornucopina ovalis sp.n. Plate VII, fig. 2; Fig. 29 A–C.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, St. 160.

GEOGRAPHICAL DISTRIBUTION. Shag Rocks (Discovery).

HOLOTYPE. St. 160.

DESCRIPTION. *Zoarium* bushy (type colony 7·5 × 7 cm.) composed of delicate branches whose rootlets form a short thick stalk to the colony (Plate VII, fig. 2).

Zooecia without digitiform process, tubular part long, expanded part turned almost at right angles to the main axis (Fig. 29 A).

Opesia long, oval. Orifice at end of opesia farthest from middle of branch, oblique, being a little to outer side of long axis of the opesia. Other end of opesia occupied by a cryptocyst with irregular, more or less straight, edge.

Spines. Usually two on a common eminence at outer corner of zooecium, and a third close to them. Usually another spine near the middle of the branch and sometimes one in the intervening space making five in all.

Basal avicularia on many zooecia, originating near main axis of branch with mandible directed towards axis (Fig. 29 A, B), attached rigidly by fairly narrow base and widening relatively suddenly, but without any clear distinction of head and stalk, palatal surface oblique.

Frontal avicularia similar, less expanded distally (Fig. 29 C), mandible directed frontally, commonly present on fertile zooecia, rarely (if ever[1]) present elsewhere.

Fertile zooecia with four spines as in other zooecia, but with shorter, broader opesia (Fig. 29 A).

Ovicell large, longer than wide, with radially striated entooecium, connexion with distal zooecium as in other species of the genus.

REMARKS. This species resembles *Cornucopina grandis* (Busk, 1852*b*, p. 42) in the shape of its opesia and the possession of a cryptocyst, but all parts of the zooecia are more elongated. The basal avicularia are smaller, and, in the typical form but not in var. *versa*, face in a direction at right angles to those of *C. grandis* and have a more oblique palatal surface. In the typical form their outline follows the curvature of the main axis of the branch so that they appear neatly fitted into the angle between the projecting part of the zooecium and the main axis.

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[1] Two fragments of a *Cornucopina* from the type-locality have frontal avicularia on non-fertile zooecia, but in the absence of basal avicularia and ovicells their identity is uncertain.

The fertile zooecia differ from the others in shape, having a shorter, rounder aperture. In *C. grandis* there is no such marked difference in the shape of the whole fertile zooecium, but the common base of the outer spines is rather long and stands beside the ovicell, following its curvature (Fig. 30 A). In *C. ovalis* these spines are basal to the ovicell and therefore hidden (except for their tips) in frontal view (Fig. 29 A), and their common base is not longer in fertile zooecia.

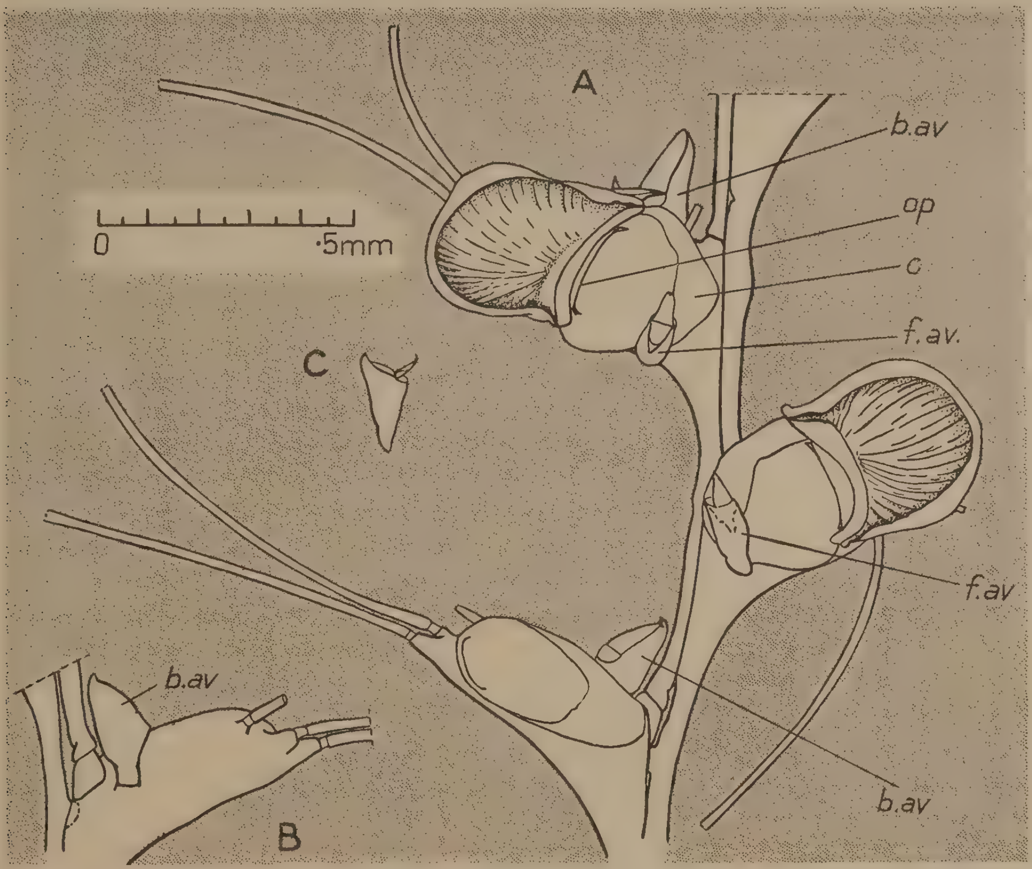

Fig. 29. A–C. *Cornucopina ovalis* sp.n. St. 160, Shag Rocks. A. Frontal view. One of the avicularia has a broken beak (dotted). B. Basal view of the non-fertile zooecium shown in Fig. A. C. Frontal avicularium in profile.

b.av. basal avicularium, *c.* cryptocyst, *f.av.* frontal avicularium, *op.* operculum.

It is clear from his figures that the specimen recorded as *Bicellaria grandis* by Waters (1904, p. 26) belonged to *Cornucopina ovalis* rather than to *C. grandis* (Busk). Unfortunately, Waters did not find avicularia or ovicells. His specimen came from the Straits of Magellan, but the depth is not recorded. As typical *C. ovalis* has only been found at the Shag Rocks, near South Georgia, and var. *versa* at the deeper Falkland stations (267–463 m.) and perhaps at Kerguelen, there is no geographical clue to the identity of Waters's form.

7. Cornucopina ovalis var. versa var.n. Fig. 30 B–D.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. WS 228, WS 229, WS 246, WS 840, WS 871.

GEOGRAPHICAL DISTRIBUTION. Off Patagonian Shelf, below 200 m. (Discovery); Kerguelen? (34.2.16.44).

HOLOTYPE. St. WS 871, off Patagonian Shelf.

These specimens resemble the type specimen of *Cornucopina ovalis* in their zooecial characters, but differ in their avicularia. Ovicells are unknown. The basal avicularia (Fig. 30 B–D) are rare. They are larger and stouter than those of the typical form, taper evenly, and project from the basal surface of the branch with the mandible directed basally (i.e. as in *C. grandis* and not as in typical *C. ovalis*). The palatal surface is terminal and transverse and the beak stout and prong-like. Frontal avicularia are commonly found on non-fertile zooecia and are usually much more numerous than in the typical form. They are a little larger than those of the typical form, but are not constantly different in shape.

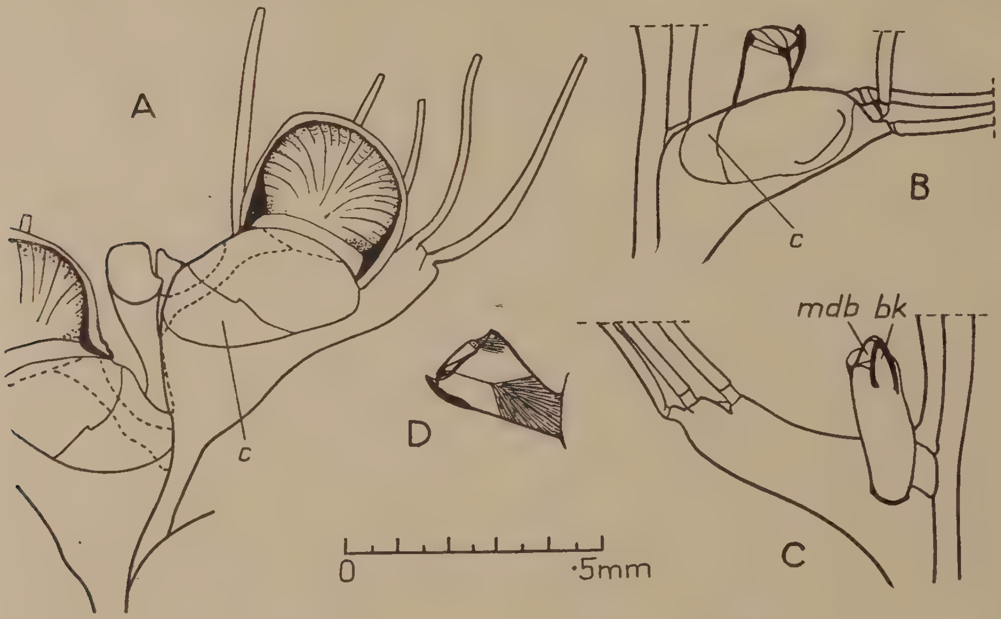

Fig. 30. A. *Cornucopina grandis* (Busk). 99.7.1.4541, Victoria (one of Goldstein's mounts) to show the relation of the spines to the ovicell for comparison with *C. ovalis*, Fig. 29 A. The connexion of the ovicells with the distal zooecia is shown by dotted lines. B–D. *C. ovalis* var. *versa* var.n. B, C. St. WS 871, off Patagonian Shelf. Frontal and basal views. D. St. WS 840, between Burdwood Bank and Patagonian Shelf. Basal avicularium as seen in a side view of the branch.

bk. beak, *c.* cryptocyst, *mdb.* mandible.

The fragments from Sts. WS 228, WS 229 and WS 246 do not possess basal avicularia but are included in the variety rather than in the typical form on account of their locality. Frontal avicularia are present on some non-fertile zooecia. There are no fertile zooecia. A similar small specimen found among unnamed material from Challenger St. 149 (Kerguelen) has also been tentatively attributed to the variety.

8. **Cornucopina zelandica** sp.n. Fig. 31 A–C.

STATION DISTRIBUTION. *New Zealand:* St. 934.

GEOGRAPHICAL DISTRIBUTION. New Zealand (Terra Nova, Sts. TN 90, TN 144; Discovery).

HOLOTYPE. St. TN 144.

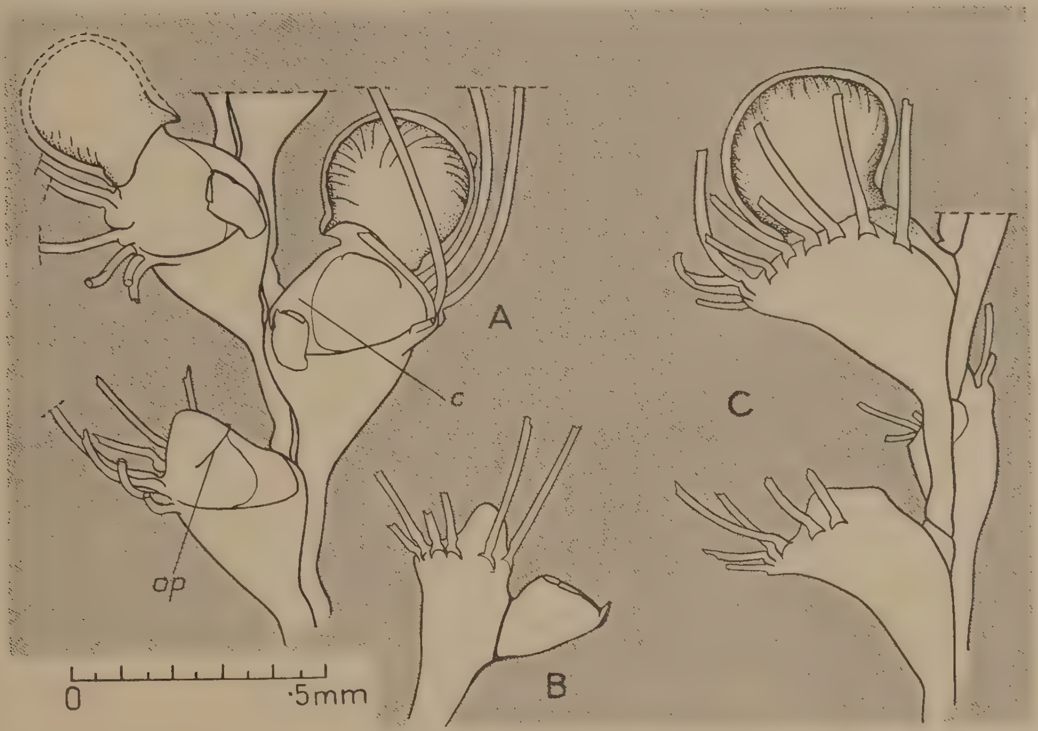

Fig. 31. A–C. *Cornucopina zelandica* sp.n. St. TN 144, New Zealand. A. Frontal view. B. Basal avicularium as seen in a side view of the branch. C. Oblique basal view.
c. cryptocyst, *op.* operculum (open).

DESCRIPTION. *Zoarium* bushy (type colony, 12 cm. high, 8 cm. broad) composed of very delicate feathery branches.

Rootlets forming a short, thick stalk.

Zooecia without a digitiform process.

Opesia short, broader than long, roughly triangular, proximal border straight, orifice at apex of triangle, outer basal angle of triangle occupying the prominent outer distal corner of zooecium. Inner basal angle with a curved cryptocyst (Fig. 31 A).

Spines, six or seven, four on distal corner, two or three in transverse row on basal surface.

Fertile zooecia a little broader than non-fertile, with eight to ten spines more evenly distributed in a transverse row (Fig. 31 C), recognizable by their shape, and by the presence of a small ovary, before development of any trace of the ovicell which appears late.

Ovicell large, taller than wide, entooecium radially striated, the spines remaining intact behind ovicell. Connexion with distal zooecium as in other species of the genus.

Avicularia of two kinds, frontal and basal, both kinds unstalked and rigidly attached.

Frontal avicularia slightly curved and placed on the proximal border of the opesia (Fig. 31 A).

Basal avicularia larger, stouter, not curved, attached to the middle of the basal surface of the expanded part of a few zooecia, projecting outwards (Fig. 31 B).

REMARKS. This species appears to be related to *Cornucopina grandis* (Busk, 1852*b*, p. 42), which is also known from New Zealand. It differs from *C. grandis* in the shape of the opesia and its relation to the axis of the branch, in the narrower, more curved, unhooked cryptocyst (see Harmer, 1902, p. 290), in the more numerous spines and the absence of any trace of a spine-bearing process (cf. Figs. 30 A and 31 A), in the presence of frontal avicularia and the smaller size of the basal ones, and in the absence of any tendency for the tips of the branches to curl.

9. **Cornucopina moluccensis** (Busk). Fig. 32 A, B.

Bicellaria moluccensis Busk, 1884, p. 34, pl. vi, fig. 4.

Cornucopina moluccensis Harmer, 1926, pp. 422, 424, pl. xxix, figs. 7–10, 13–16 (synonymy); Hasenbank, 1932, p. 339, text-fig. 13 A–F.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Indian Ocean (Hasenbank); Malay Archipelago (Busk; Harmer); New Zealand (Terra Nova).

These specimens agree with *Cornucopina moluccensis* in the appearance of the colony and the general form of the zooecia. The spines have the same arrangement, and the avicularia are similar in position and form. Ovicells have not been found. The opesia extends to the end of the spine-bearing process, and there is a rather long cylindrical region between the tubular basal part of the zooecium and the opesia (Fig. 32 B). In these respects this material corresponds to Harmer's fig. 15. It differs from that figure, and from *C. moluccensis* in general, in the large size of the swelling of the proximal zooecium from which the daughter zooecium springs (Fig. 32 A, B) and in the shortness of the digitiform process. The avicularia are all of the long trumpet-shape with transverse mandible (Harmer, pl. xxix, fig. 7) and are variable in size.

10. **Cornucopina angulata** (Kluge).

Bicellaria angulata Kluge, 1914, p. 641, text-fig. 23.

Cornucopina angulata Harmer, 1926, p. 422.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Southern Ocean, 2450 m. (Kluge).

I have not seen a specimen of *Cornucopina angulata*. It may prove to be a synonym of *C. navicularis* Busk (1884, p. 32, pl. vii, fig. 2) from Challenger St. 122, a deep-water station off Brazil. Busk's type specimen differs from Kluge's description in the presence of a small basal spine near the point of origin of the daughter-zooecium; in the frequent presence of a basal avicularium similar in shape to the frontal one, and placed about half way between the two single basal spines; and in the absence of a cryptocyst. It has large, fluted hyperstomial ovicells borne on zooecia which are rather larger than the non-fertile zooecia.

The specimen from Challenger St. 332, recorded by Busk as *C. navicularis*, agrees with *C. rotundata* (Kluge), and differs from the type of *C. navicularis* in its spine-bearing process which is longer with the spines less evenly distributed; in its opesia which is more oval in shape and does not extend towards the daughter-zooecium; and in the shape of the basal avicularium. There are no frontal avicularia and no ovicells.

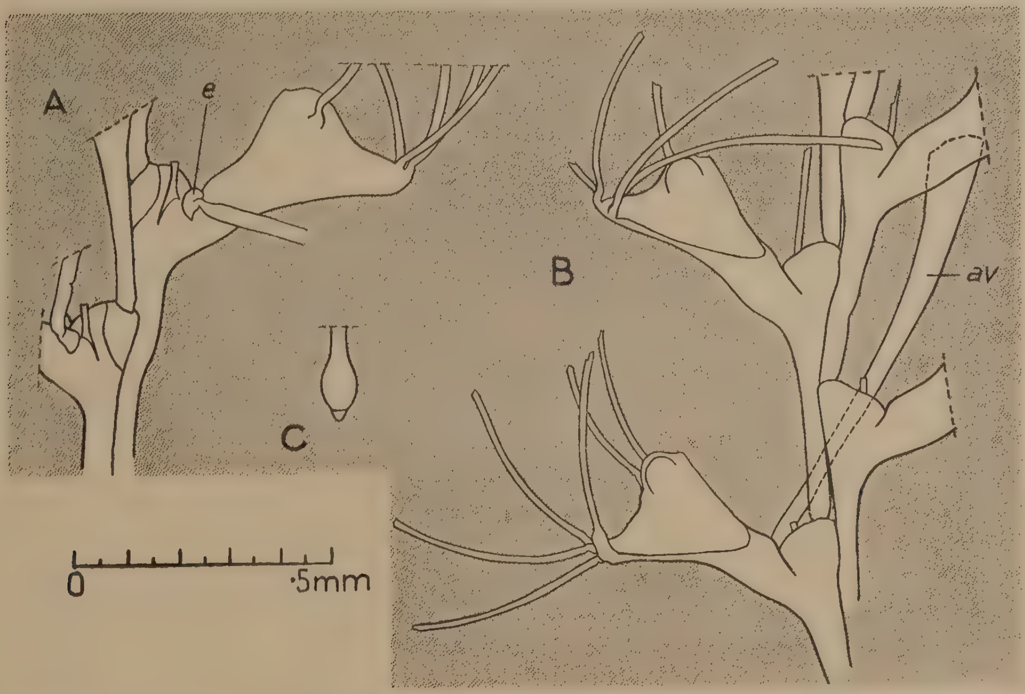

Fig. 32. A, B. *Cornucopina moluccensis* (Busk). St. TN 90, New Zealand. C. *C. pectogemma* (Goldstein). 87.12.9.157. Challenger St. 145, near Prince Edward Island. Base of avicularium, showing bulb and transverse septum.

av. avicularium, *e.* eminence to which avicularium is attached.

11. Cornucopina rotundata (Kluge).

Bicellaria rotundata Kluge, 1914, p. 640, pl. xxxiii, fig. 2.

Cornucopina rotundata Harmer, 1926, p. 422.

Bicellaria navicularis (part) Busk, 1884, p. 32. [Specimen from St. 332.]

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. 35° 39′ S, 50° 47′ W. South Atlantic Ocean, 4026 m. (Busk); Southern Ocean, 3397 m. and 3423 m. (Kluge)

The specimen from Challenger St. 332 recorded by Busk as *Cornucopina navicularis* differs from the type-specimen of that species, see above, and closely agrees with *C. rotundata*, differing only in the absence of the small frontal avicularium, and in having two instead of three terminal spines on the spine-bearing process which, besides the two terminal spines, carries one spine at a short distance from the tip and a fourth spine part way between the third spine and the base of the process. As in Kluge's figure, there is also a spine on the basal surface of the zooecium near the point of origin of the spine-bearing process and another near the origin of the daughter-zooecium.

Beania Johnston, 1840

Key to the species discussed here

1.	Basal spines absent, avicularia typically present (absent in some specimens)	2
	Basal spines present, avicularia absent	9
2.	Connecting tubes all at proximal end, greater part of zooecium erect	3
	Connecting tubes distributed all round prostrate zooecium	5
3.	Six connecting tubes, not more than two distal spines	4
	Four connecting tubes, at least six distal spines	**12. B. scotti**
4.	Zooecia small, a few marginal spines present, avicularia hump-backed, beak forming more than half their length, ovicell with tube passing to distal zooecium	**9. B. challengeri**
	Zooecia large, no marginal spines, avicularia flat-backed, beak forming less than half their length, ovicell without tube	**10. B. erecta**
5.	Six connecting tubes	6
	Four connecting tubes	**13. B. intermedia**
6.	Marginal spines absent	**8. B. magellanica**
	Marginal spines present	7
7.	Avicularia rare, single, passing between connecting tubes to basal surface	**4. B. inermis**
	Avicularia constantly present, frequently paired, not passing to basal surface	8
8.	Two horn-like processes on operculum, avicularia with short beak	**1. B. costata**
	No horn-like processes on operculum, avicularia with relatively long, but variable, beak	**3. B. discodermiae**
9.	Zooecia very long, recumbent, connected by six short, stout tubes, basal spines in single median line, branched	**7. B. pulchella**
	Zooecia not exceptionally long, erect, connected by four to six long, thin tubes, basal spines unbranched, scattered, chiefly towards periphery	**6. B. fragilis**

1. Beania costata (Busk).

Diachoris costata Busk, 1876, p. 116; 1879, p. 195, pl. x, figs. 4–6; Vallentin, 1924, p. 374.

Beania costata Kluge, 1914, p. 647, text-fig. 27 (references).

not *Beania costata* MacGillivray, 1886*b* (see *B. discodermiae*).

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. 48, 56; South Indian Ocean, St. 1562.

GEOGRAPHICAL DISTRIBUTION. Magellanic Region (Jullien; Calvet); Patagonian Shelf (Busk; Vallentin; U.S. National Museum; Discovery); Marion Island (Discovery); Kerguelen (Busk; Kluge).

This material agrees with Busk's descriptions and specimens. The pair of horn-like processes on the operculum described and figured by Jullien are constantly present. The gigantic avicularia mentioned by Hincks (1885) are present in several Falkland specimens.

A specimen collected at the Falkland Islands on 22 April 1927 (U.S. National Museum) has an ancestrula similar to that of *Beania costata* var. *maxilla* (see below).

Examination of specimens from Port Phillip Heads in the Bracebridge Wilson collection (97.5.1.383, 384, 386), identified as *B. costata* and agreeing very exactly with MacGillivray's description and figures, confirms Kluge's opinion that the Australian species is distinct. It appears to be very closely related to *B. discodermiae* (Ortmann) (see p. 410). The spines are rather numerous and there are usually two springing from the distal wall, behind the oral ones which are on the edge of the opesia. The avicularia are within the range of variation described by Harmer (1926, p. 415) but the very large ones are not present.

2. **Beania costata var. maxilla (Jullien).** Fig. 33 B, C.

Diachoris maxilla Jullien, 1888, p. 74, pl. vii, fig. 3, pl. xi, fig. 4.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, St. WS 85.

GEOGRAPHICAL DISTRIBUTION. Tierra del Fuego (Jullien); Falkland Islands (Discovery).

This form is so closely allied to *Beania costata* that I regard it as a variety. The chief difference is in the processes on the operculum, which are branched. They may appear irregularly stellate as in Jullien's figure (pl. xi, fig. 4), or the distally directed branch may be the most highly developed (Fig. 33 B, C). There are other differences of slight systematic value, namely, the presence of three (instead of two) pairs of erect distal spines, the shorter zooecia, and the smaller avicularia. Except on the ancestrula (Fig. 33 B) the spines in my material are longer than those figured by Jullien and resemble those of *B. costata*.

Some of the rootlets, like those of *B. inermis* and other species (see p. 411), have a branched tip and, as in *B. discodermiae* and *B. petiolata* (see Harmer, 1926, pp. 415, 416), a proximal lateral rootlet is sometimes present, in addition to the more distal median one.

The ancestrula (Fig. 33 B) is like the other zooecia in shape, but has shorter, more erect, spines. From the clearly defined flattened area on its basal surface one may deduce that it was encrusting. All the other zooecia have a curved basal surface which was clearly unattached.

Waters (1889, p. 4) gave this form as a synonym of *B. quadricornuta* (Hincks, 1885, p. 245), an Australian species. Hincks does not show any opercular processes, there are only four oral spines, and his figured zooecia, which are close together, do not become narrower in the region of the operculum as do those of the present specimen, and several of those figured by Jullien. In view of these differences, and of their wide geographical separation, and in the absence of undoubted specimens of *B. quadricornuta* for comparison, it seems best to treat them as distinct.

3. Beania discodermiae (Ortmann).

Diachoseris discodermiae Ortmann, 1889, p. 26, pl. i, fig. 23.

Beania discodermiae Harmer, 1926, p. 415, pl. xxviii, figs. 9, 10.

? *Beania costata* MacGillivray, 1886*b*, p. 68, pl. cxvii, figs. 3, 3*a*, 3*b* (not *B. costata* Busk).

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Japan (Ortmann); Malay Archipelago (Harmer); Victoria? (MacGillivray); New Zealand (Terra Nova).

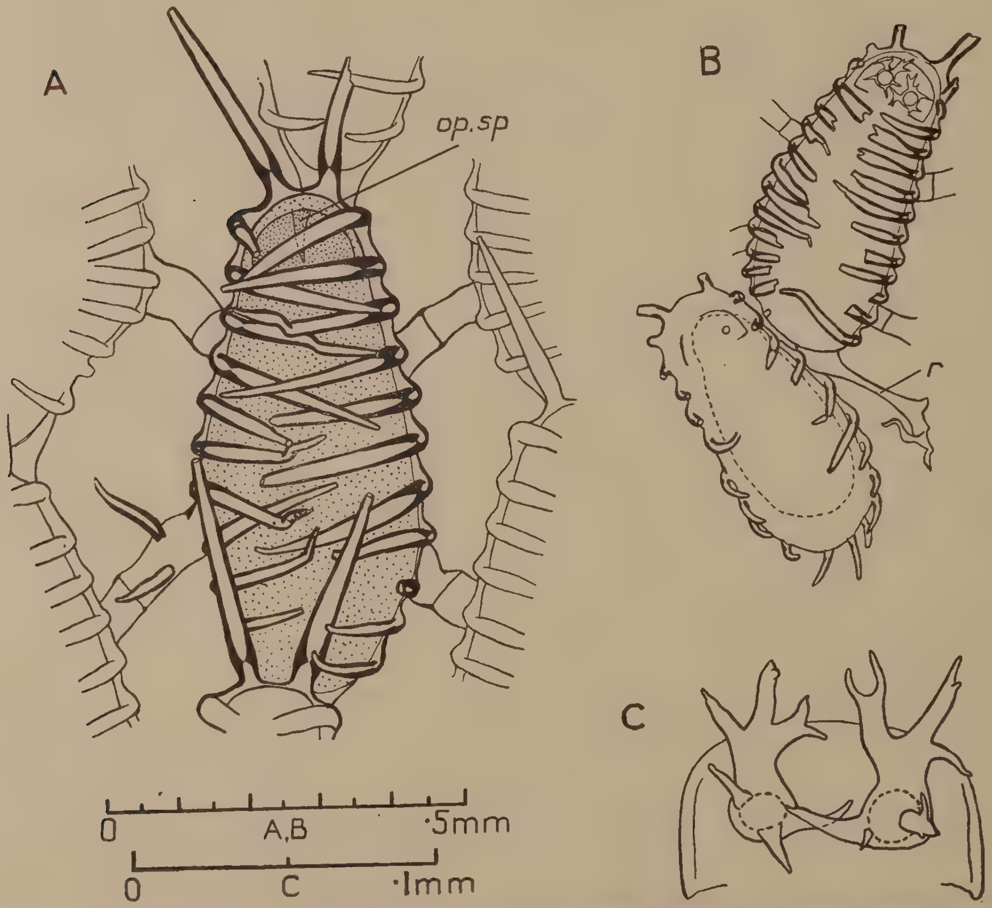

Fig. 33. A. *Beania inermis* var. *unicornis* var.n. St. WS 84, Falkland Islands. One zooecium with parts of adjacent zooecia sketched. B, C. *B. costata* var. *maxilla* (Jullien). St. WS 85, Falkland Islands. B. Ancestrula and one zooecium. The dotted line outlines the area of fixation of the ancestrula. The operculum of the ancestrula is incomplete. C. Operculum in frontal view.

op.sp. opercular spine, *r.* rootlet.

A fragmentary specimen in the Terra Nova collection agrees exactly with *Beania discodermiae* as described by Harmer. The reasons for regarding *B. costata* MacGillivray as a possible synonym of *B. discodermiae* are given on p. 409 above.

4. Beania inermis (Busk).

Diachoris inermis Busk, 1852*b*, p. 54; 1854, pl. lxxii, figs. 1, 2; 1879, p. 194; 1884, p. 60; Jullien, 1888, p. 73, pl. x, fig. 1; Kirchenpauer in Studer, 1889, p. 157.

Beania inermis O'Donoghue and de Watteville, 1935, p. 208.

Diachoris hyadesi Jullien, 1888, p. 74, pl. vii, figs. 1, 2.

Beania hydesia Waters, 1904, p. 30, pl. i, fig. 7.

? *Beania hyadesi* Calvet, 1909, p. 13.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. WS 85, WS 88.

GEOGRAPHICAL DISTRIBUTION. Magellanic Region (Busk; Jullien; Waters); Patagonian Shelf (U.S. National Museum; Discovery); John Adams Bank, off Brazil (99.7.1.912, 926); South Africa (O'Donoghue and de Watteville); St Paul (Kirchenpauer); Kerguelen (Busk); Palmer Archipelago? (Calvet).

I have been unable to trace any specimen on which Busk might have based his record of this species from New Zealand (1852*b*, p. 54), and Hutton (1873, p. 94, asterisk explained on p. 1) listed it on Busk's authority without having seen specimens. I have myself seen no specimen from New Zealand.

From comparison of the original figures and descriptions, it appears that *Beania inermis* (Busk) and *B. hyadesi* (Jullien) differ in the number of spines, which, as Waters pointed out, might be due to the worn state of Busk's type specimen. The Discovery material confirms this suggestion, both conditions being found in a single partially worn colony from St. WS 85. Another colony from the same station, with the full complement of small acute spines, has avicularia and rootlets as described by Waters.[1] The presence of rootlets with branched tips is, however, not peculiar to this species. They have, for example, been observed in *B. hirtissima* (Heller), *B. fragilis* (Ridley) and *B. costata* var. *maxilla* (Jullien).

The avicularia, described by Waters as situated on a slightly raised chamber on the dorsal surface, prove to be stalked and attached to the border of the aperture just distally to the distal lateral connecting tube, as in several other species of *Beania*, but the stalk passes through the fenestra so that the avicularium projects on the basal surface of the colony. The large swollen head could not have passed through the fenestra, and the avicularium must have developed in this position. As usual in this genus the colonies were not encrusting, but fixed by rootlets. They were growing on the surface of other Polyzoa and as the rootlets were short the space between the colony and the substratum was very narrow. The presence of large avicularia in this space is rather surprising.

The specimens from the John Adams Bank, off Brazil, have avicularia in the basal position characteristic of the species, and, with their small and unevenly distributed spines, much resemble the type. Avicularia are absent in O'Donoghue and de Watteville's South African material (1936.4.2.7) and from the single piece from Kerguelen in the Challenger collection. Both specimens have irregularly distributed spines and resemble the type in general appearance. In the Kerguelen specimens from the Eaton collection, recorded by Busk (1879), the four distal spines are stouter than is usual, there are no lateral spines, and the connecting tubes are mostly not quite so short as in the typical specimens. A single rather compressed avicularium is present, projecting basally, and branched rootlets are numerous and extremely short. From the limited material available there seems no reason for separating this from *B. inermis*, especially as a specimen from Port William, Falkland Islands (U.S. National Museum), has exactly similar spines. This Falkland specimen has short connecting tubes, as in the type, and no avicularia.

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[1] Waters writes of the origin of the rootlet as proximal, but if the mandible points proximally, as in my specimens, the rootlets in his figure are distal.

Very shallow, cap-like ovicells are numerous in the Eaton Kerguelen material (see 99.7.1.918). The edges of the ectooecium and entooecium are seen in frontal view, and, owing to the shortness and distal position of the distal zooecial connecting tube, the ovicell makes contact with the distal zooecium without having a tubular prolongation such as is found in *B. magellanica*. The fertile zooecia contain large embryos.

Calvet did not make it clear whether the avicularia of his specimen appeared on the basal surface, and his comparison with *B. elongata* and *B. quadricornuta* suggests that they were in the more normal frontal position. The identity of his specimens is thus very uncertain, especially as this would be the only record of the species south of the Antarctic Convergence (see Table 3, p. 479).

5. **Beania inermis var. unicornis var.n.** Fig. 33 A.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. 1321, WS 84, WS 85, WS 776.

GEOGRAPHICAL DISTRIBUTION. Magellanic Region; Patagonian Shelf (Discovery).

HOLOTYPE. St. WS 84, Falkland Islands.

These specimens agree with typical *Beania inermis* in their avicularia. The marginal spines are longer and stouter, crossing over at their tips (Fig. 33 A). The oral spines consist of one pair of distal spines, as the next spine on each side, though it may be a little stouter than the other marginal spines, slopes inwards. The zooecia do not have the wavy outline usually seen in the typical form, and the connecting tubes are longer and may bear two or three spines, like the marginal spines of the zooecia. There is a spinous structure directed outwards and backwards from the middle of the free edge of the operculum.

These features give the colony a distinctly different appearance from that of typical *B. inermis*, and, in the material available, are constant and definite.

Branched rootlets are present.

In one specimen (St. 1321) a few of the connecting tubes are somewhat dilated and have an oval uncalcified frontal area surrounded by spines. Their appearance suggests abortive zooecia, and it may be that the otherwise normal tubes that bear two or three spines (Fig. 33 A) are more extreme examples of the same condition.

In some ways var. *unicornis* resembles *B. vanhöffeni* Kluge (1914, p. 647), described from a specimen from Simons Bay, but in Kluge's species the distal marginal spine on each side is erect and much enlarged. These erect, stout spines are present in a specimen from the Cape of Good Hope (92.3.16.6) which agrees very closely with Kluge's description and figure. *B. vanhöffeni*, as represented by this specimen, also differs from var. *unicornis* in the absence of the spinous process on the operculum. It has no avicularia. Branched rootlets are present. *B. vanhöffeni* is evidently nearly related to *B. inermis* but does not agree exactly with either the typical form or with var. *unicornis*.

B. paucispinosa O'Donoghue and de Watteville (1935, p. 208), which also came from South Africa, is probably identical with *B. vanhöffeni*, as noted by Marcus (1937, p. 63). The erect distal pair of marginal spines is not so stout as in *B. vanhöffeni*. Although the authors state that the method of interzooecial union is different from that of *B. inermis*, their description of the connecting tubes would apply equally well to *B. inermis*. The Discovery specimen compared by O'Donoghue and de Watteville with *B. paucispinosa* belongs to the present variety, specimens with avicularia not having been found at that time.

Okada and Mawatari (1938, p. 454) compared their Japanese species, *B. octaceras*, to *B. vanhöffeni*. From their figure I should judge their species to be related to the Membraniporidae rather than to *Beania*. In many ways it resembles certain species of *Pyrulella* discussed by Hastings (1930, p. 710).

6. **Beania fragilis** (Ridley).

Chaunosia fragilis Ridley, 1881, p. 45, pl. vi, fig. 1; Hincks, 1881*b*, p. 133.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. WS 84, WS 85.

GEOGRAPHICAL DISTRIBUTION. Magellan Strait (Ridley); Falkland Islands (Discovery).

These specimens agree exactly with Ridley's type specimen. They differ from *Beania hirtissima* (Heller, 1867, p. 94) in the greater length of the zooecia and in their erect position. There may be four or six connecting tubes and they all spring from the extreme proximal end of the zooecium, giving an appearance of branched stolons, as shown by Ridley. In *B. hirtissima* there are six connecting tubes, and the anterior lateral pair springs from about the middle of the side of the zooecium, only the distal half of which is erect. The rootlet in *B. fragilis* originates at the point from which the connecting tubes radiate, which corresponds to the point of origin of the rootlet in *B. hirtissima*.

The spines of *B. fragilis* are numerous and long and, although two sometimes originate very close together, are unbranched as noticed by Ridley. The marginal spines overarching the opesia are rather more slender and pointed than those which, as in the type, are scattered over the lateral and distal parts of the basal surface. Spines are rare on the central part of the basal surface.

The operculum is well chitinized. It has a thickened edge (shown white in Ridley's figure) bearing a blunt, median triangular process. It is quite distinctly marked off from the frontal membrane.

Despite Ridley's contrary statement, there is no gizzard.

7. **Beania pulchella** Livingstone.

Beania pulchella Livingstone, 1929, p. 56, pl. i, fig. 15, text-fig. 1.

STATION DISTRIBUTION. *New Zealand:* St. 934.

GEOGRAPHICAL DISTRIBUTION. New Zealand (Livingstone; Discovery).

The one small specimen of this species is without ovicells. On the whole it agrees very closely with Livingstone's description, but the spines of the outer series distinctly originate as branches from the bases of the spines of the inner series. The basal spine-bearing processes are arranged in a single row along the median longitudinal line of the zooecium. O'Donoghue and de Watteville (1935, p. 209) assumed from Livingstone's description, which is perhaps ambiguous on this point, that the zooecia are arranged in transverse rows in this species, but Livingstone's photograph and the present specimen both show the usual alternation in which each zooecium is connected with six others. The tubes are short and stout. The distal tube arises from the basal surface of the zooecium at some distance (two-thirds to one-half the length of the zooecium) from the distal end, and merges, without any recognizable point of transition from tube to zooecium, into the distal zooecium. Although the zooecia thus overlap each other considerably, they lie flat as in Livingstone's photograph. In *B. hirtissima*, where the distal tube also originates at some distance from the distal end of the zooecium, the free distal portions of the zooecia are more or less erect.

8. **Beania magellanica** (Busk). Figs. 34 C, 35 G.

Diachoris magellanica Busk, 1852*b*, p. 54, pl. lxvii, figs. 1–3; Vallentin, 1924, p. 374.

Beania magellanica Harmer, 1926, p. 412, pl. xxviii, figs. 1–4, text-fig. 21 (references); Livingstone, 1929, p. 60; Hasenbank, 1932, p. 340, text-fig. 14 A–C; Livingstone, 1937, p. 379; Neviani, 1939, p. 18.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. 58, 724, 1321, 1909, WS 81, WS 84, WS 85, WS 88, WS 93, WS 221, WS 225, WS 229, WS 231, WS 237, WS 243, WS 755, WS 784, WS 825, WS 838; South Indian Ocean, Sts. 1562, 1563, 1564.

GEOGRAPHICAL DISTRIBUTION. Mediterranean (Heller; Jullien; Waters; Harmer; Neviani; and others); Cape Verde Islands (Jullien; Calvet); John Adams Bank, off Brazil (99.7.1.4674); Magellanic Region (Jullien; Waters; Calvet; Discovery); Patagonian Shelf (Busk; Vallentin; U.S. National Museum; Discovery); off Patagonian Shelf, down to 240 m. (Discovery); South Africa (Jullien; Marcus; O'Donoghue; Hasenbank); Mauritius (Jullien); Marion Island; Prince Edward Island (Discovery); Kerguelen (Busk; Kluge); Australia (MacGillivray; Waters; Harmer; Livingstone); New Zealand (Waters; Livingstone); Auckland Island (01.12.26.33, Southern Cross Expedition); Japan (Jullien; Ortmann; Yanagi & Okada; Harmer).

Extensive sheets of this species were taken at Port Stanley, Falkland Islands (St. 56) on 19 May 1926, and in some pieces every zooecium is fertile. The fertile zooecia have a shoulder on each side of the ovicell, but have no distal spines. The presence of ovicells may account for the absence of spines in Hasenbank's fragment from South Africa.

Records of this species from New Zealand have sometimes been based on specimens of *Beania bilaminata* (Hincks). For example, those from Dr Lyell recorded by Busk (1852*b*, p. 54), and material sent to the British Museum by Hutton as *B. magellanica*

(75.1.5.75) both belong to Hincks's species. True *B. magellanica* is, however, found in New Zealand, for Waters (1906, pp. 14, 15) and Livingstone (1929, pp. 59, 60) both recognized the two species. The British Museum possesses a dozen specimens of *B. bilaminata*, all from New Zealand, one of which was figured by Hastings (1939, text-fig. 273 B, p. 328).

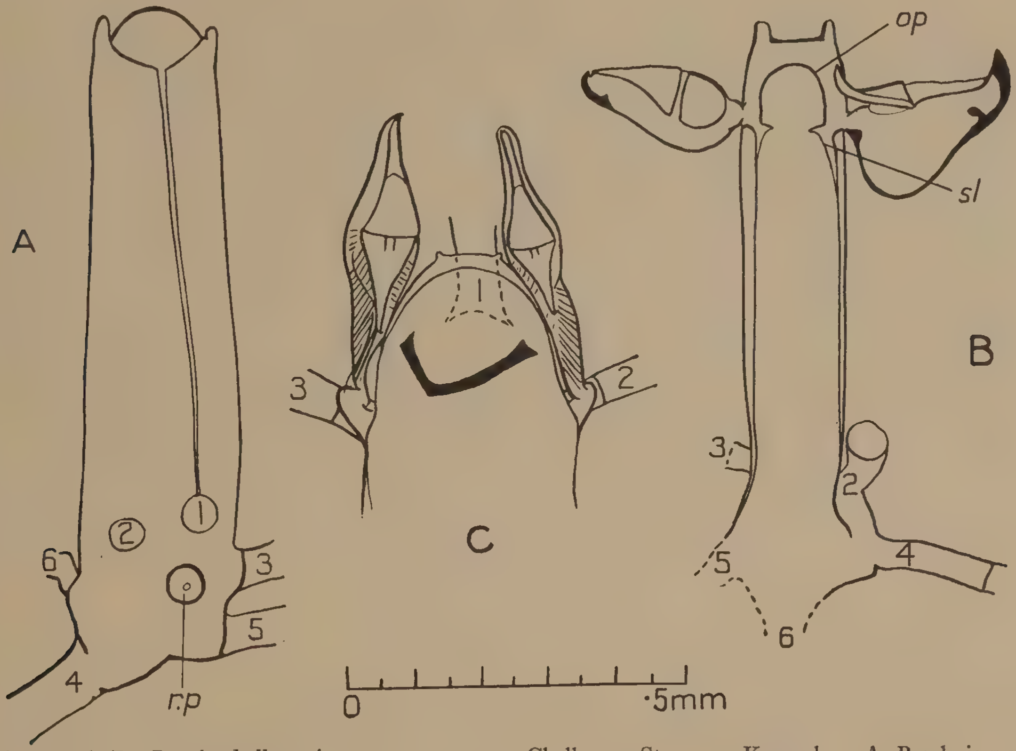

Fig. 34. A, B. *Beania challengeri* sp.n. 34.11.12.9. Challenger St. 149 D, Kerguelen. A. Basal view of fertile zooecium. B. Frontal view of a non-fertile zooecium. The proximal part was partly obscured by the next zooecium and is sketched with dotted lines. The distal connecting tube is also hidden. C. *Beania magellanica* (Busk). St. 1564, Prince Edward Island. Distal end of zooecium for comparison with Fig. B. The operculum is open.

op. operculum, *r.p.* rootlet-pore, *sl.* supposed sclerite in frontal membrane. The connecting tubes are numbered 1 distal, 2–5 lateral, 6 proximal.

9. **Beania challengeri** sp.n. Fig. 34 A, B.

Beania magellanica var. *distans*[1] Busk, 1884, p. 59, pl. xvi, figs. 2, 2*a*.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Kerguelen (34.11.12.9); Heard Island (Busk).

HOLOTYPE. Challenger St. 149 D, Kerguelen, 34.11.12.9. This specimen was found among unnamed material in Busk's collection.

DESCRIPTION. *Zooecia* erect, straight-sided, rectangular distally, with a peg-like spine at each corner (Fig. 34 B). One small marginal spine (rarely two) frequently present on each side of distal half of opesia (absent in the figured zooecium).

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[1] The varietal name is not available for the new species as it is preoccupied by *B. distans* Hincks (1881).

Connecting tubes six, arising near proximal end.

Avicularia stalked, attached at the level of the operculum, the beak forming more than half the total length, the muscle-chamber strongly humped dorsally.

Ovicells very shallow, connected with distal zooecium by tube extending whole length of basal surface of erect part of zooecium to meet remote distal connecting tube (Fig. 34 A).

REMARKS. Busk distinguished this form from typical *Beania magellanica* by the single phrase "zooecia widely distant". As can clearly be seen in his figure the difference lies not only in the length of the connecting tubes, but in their origin near the proximal end of an otherwise erect zooecium. In this the variety resembles *B. erecta*, but its zooecia and avicularia are very much smaller and differ in shape, and I have seen no trace of marginal spines in *B. erecta*, and no connexion between the ovicell and the distal zooecium.

Further differences from *B. magellanica* lie in the small size, straight sides and angular distal end of the zooecia (cf. Fig. 34 B and C); in the presence of marginal spines; and in the short, humped avicularia (cf. Figs. 34 B and 35 G). The only point of special resemblance to *B. magellanica* is the connexion of the ovicell with the distal zooecium. There is thus no adequate evidence that this form is specially related to either *B. magellanica* or *B. erecta*, and it seems best to treat it as a distinct species.

Busk's drawing represents a dried specimen in which the shrivelling of the soft parts has drawn the edges of the opesia together. Levinsen (1909, p. 100) was misled by this when he suggested that a new genus was represented.

10. **Beania erecta** Waters. Plate IX, fig. 2; Fig. 35 A, F.

Beania erecta Waters, 1904, p. 30, pl. i, fig. 8 *a–e*.

? *Beania erecta* Calvet, 1909, p. 13; Kluge, 1914, p. 649, text-fig. 29*b*.

not *Beania erecta* Livingstone, 1928, p. 26, pl. v, fig. 4; Hasenbank, 1932, p. 342, text-fig. 15.

? not *Beania erecta* Thornely, 1924, p. 7.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, Sts. 160, 371; Victoria Quadrant, Sts. 1648, 1651, 1652, 1660.

GEOGRAPHICAL DISTRIBUTION. Shag Rocks; South Sandwich Islands (Discovery); Bellingshausen Sea (Waters); Ross Sea (National Antarctic Expedition; Terra Nova; Discovery).

The Discovery material of *Beania erecta* comprises two distinct forms. One appears to agree with typical *B. erecta*, the other is described below as *B. erecta* var. *livingstonei*. Livingstone's figured specimens belonged to this variety, but where no figure of the zooecium (e.g. Kluge, 1914, p. 649) is given it is impossible to tell which form is recorded, though it is probable that Thornely, working on the same collection as Livingstone, based her record on the variety.

The ovicell of *B. erecta* is very shallow and flanked by the distal spines (Fig. 35 A). In frontal view its double edge can be seen. Basally it is oval in outline, the lateral walls continuing the line of the spines and meeting a transverse thickening of the basal wall. There is no tubular continuation such as is found in *B. magellanica*.

The rootlets arise from a short calcareous tube which projects from the recumbent part of the basal surface. It may arise not far from the centre of this area, projecting obliquely, but more frequently arises close to the distal connecting tube, pointing in the same direction as the tube. The rootlets may be very stout, though thin walled, and frequently ramify at the tips.

In the colonies from St. 160 (Shag Rocks) the zooecia are small and the connecting tubes unusually long (Plate IX, fig. 2).

In a small specimen from St. 1652 there is a zooecium without avicularia which, from its position with its back to all the other zooecia, i.e. with its frontal surface uncovered, and from the absence of any trace of the three proximal connecting tubes, appears to be the ancestrula. The next zooecium has a pair of avicularia which are placed more proximally than usual, being at about the middle of the length of the upright part of the zooecium. The ancestrula resembles the other zooecia in shape and has the two distal spines.

The specimen from the Agulhas Bank, attributed to this species by Hasenbank, differed from both the typical form and the variety in its very long and slender avicularia, in the absence of the two small distal spines, in its longer connecting tubes, and in the less proximal position of the three distal tubes. The shallow ovicell has a tube passing to the distal connecting tube as in *B. magellanica* and *B. challengeri.*

11. **Beania erecta var. livingstonei var.n.** Plate IX, fig. 1; Fig. 35 B, E.

Beania erecta Livingstone, 1928, p. 26, pl. v, fig. 4.

? *Beania erecta* Thornely, 1924, p. 7.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, Sts. 42, 140, 159, 170, 175, 177, 190, WS 27.

GEOGRAPHICAL DISTRIBUTION. South Georgia (Discovery; Shackleton-Rowett Expedition); Elephant Island; South Shetland Islands; Palmer Archipelago (Discovery); Adelie Land (Livingstone); Ross Sea (Terra Nova).

HOLOTYPE. St. 159, South Georgia.

The whole distal end of the fertile zooecium of the variety is less blunt (cf. Fig. 35 A and B) and more markedly different from that of the non-fertile zooecium than in the typical form. Even at the low magnification of Plate IX, fig. 1, the distal ends of a few fertile zooecia, towards the middle and upper part of the figure, are distinguishable by their shape from the simply semicircular ends of the non-fertile zooecia. In both fertile and non-fertile zooecia the spines are nearer together than in typical *Beania erecta*, and the ovicell, which in both is shallow and fits between the spines, is thus correspondingly narrower. The distal border of the ovicell is more convex than in the typical form, and the lateral walls converge giving the ovicell a roundly triangular outline. The spines tend to lean towards the ovicell instead of pointing distally. The operculum has a distal protrusion which fits the more convex orifice of the ovicell, but, as the tip of the operculum curves inwards (i.e. towards the ovicell), this feature shows better in erect zooecia seen from above than in those mounted flat and seen in frontal view. It is recognizable in the marginal zooecia in Livingstone's pl. v, fig. 4, and shows that he had the variety.

The zooecia are rather larger and usually more hump-backed than those of the typical form.

The difference in the position of the avicularia is not always as marked as in the figured specimens. In shape, too, the avicularia of both the species and the variety are somewhat variable, and the distinction that appears in the figures is much less marked in other specimens.

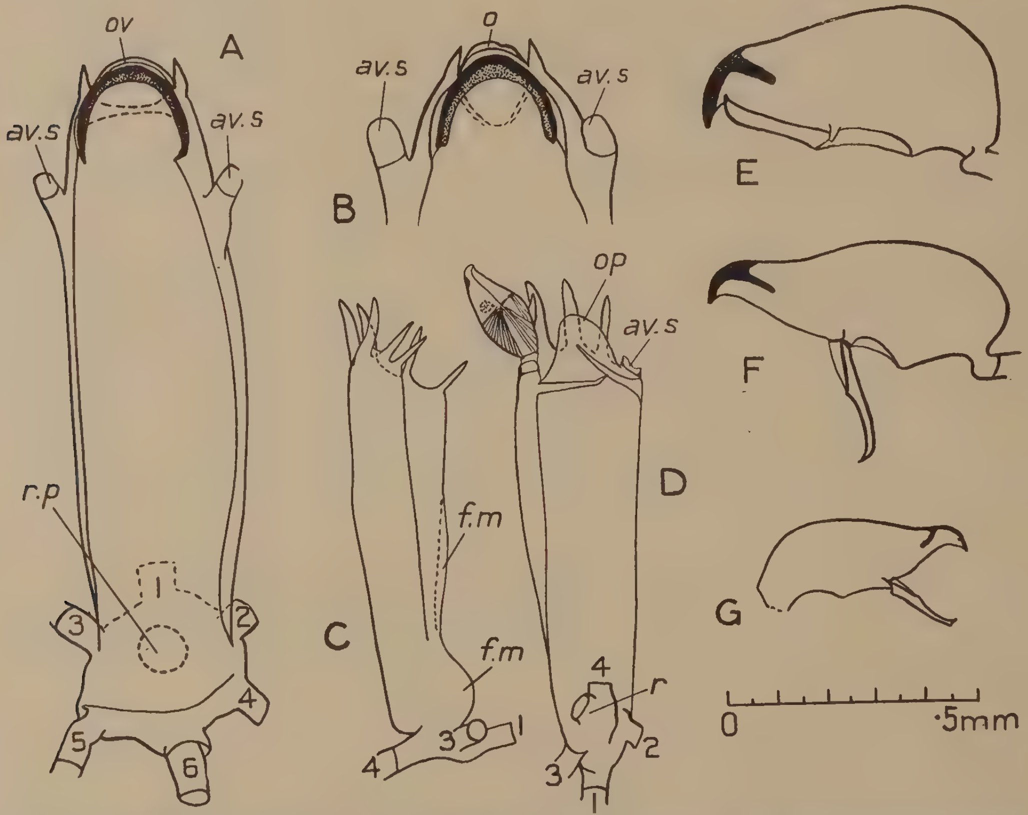

Fig. 35. A. *Beania erecta* Waters. St. 160, Shag Rocks. Fertile zooecium. The proximal connecting tube appears to have regenerated. B. *B. erecta* var. *livingstonei* var.n. St. 159, South Georgia. Distal end of fertile zooecium. C, D. *B. scotti* sp.n. St. TN 194, off Oates Land. In Fig. C the operculum was open and the remains of the tentacle-sheath everted, but these parts have been omitted from the drawing for clarity. The frontal membrane of this zooecium has sagged in preservation. E. *B. erecta* var. *livingstonei* var.n. St. 159, South Georgia. Avicularium. F. *B. erecta* Waters. St. 160, Shag Rocks. Avicularium. G. *B. magellanica* (Busk). St. 1564, Prince Edward Island. Avicularium.

av.s. avicularian stalk, *f.m.* frontal membrane, *op.* operculum, *o.* ovicell, *r.* supposed rootlet, *r.p.* rootlet-pore. The connecting tubes are numbered thus: in *B. erecta* (with 6), 1 distal, 2–5 lateral, 6 proximal; in *B. scotti* (with 4), 1 distal, 2–3 lateral, 4 proximal.

12. **Beania scotti** sp.n. Fig. 35 C, D.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Oates Land (St. TN 194).

HOLOTYPE. St. TN 194.

Description. *Zooecia* erect, straight-sided, tapering towards proximal end (Fig. 35 D).

Connecting tubes four, arising very close together at proximal end.

Avicularia stalked, attached to distal border, between the two outer spines on each side, sometimes absent.

Spines all distal, prong-like, six on aviculiferous zooecia, the outer spine on each side bending over opesia, seven on zooecium without avicularia (Fig. 35 C), all directed distally.

Ovicells unknown.

Remarks. Only three zooecia of this species of *Beania* have been found but they are so unlike those of any known species that I can only regard them as new in spite of the undesirability of describing species from scanty material.

B. scotti differs from *B. erecta* in the shape of the zooecia, the number and length of the distal prongs, and the shape and position of the avicularia. It appears also to differ in having four connecting tubes instead of six, though this point cannot be settled with certainty from this material as the tubes are not mounted in a convenient position.

A structure which appears to be the stump of a rootlet arises very near the proximal connecting tube in the zooecium shown in Fig. 35 D.

13. Beania intermedia (Hincks). Fig. 36 B.

Diachoris intermedia Hincks, 1881*b*, p. 133, pl. v, fig. 8.

Beania intermedia MacGillivray, 1890, p. 346, pl. cxcv, figs. 3, 3*a*; Waters, 1906, p. 15, pl. i, figs. 16–18. [Typical form.]

Beania intermedia Waters, 1909, p. 137; Osburn, 1914, p. 189; Kluge, 1914, p. 644, text-fig. 25; Hastings, 1927, p. 334; 1930, p. 705; Marcus, 1938*b*, p. 210, text-fig. 15. [Form without marginal spines.]

Diachoris intermedia Thornely, 1907, p. 184.

Beania intermedia Thornely, 1912, p. 142.

Station distribution. Not represented in the Discovery collections.

Geographical distribution. Tasmania (Hincks); Victoria (MacGillivray); New Zealand (Waters; Terra Nova); Chatham Island (Waters); Indian Ocean (Thornely); Red Sea (Waters); Suez Canal (Hastings); Cape Verde Islands (Kluge); Tortugas (Osburn); St Helena (Marcus); Gorgona (Hastings).

The Discovery specimen agrees very closely with *Beania intermedia* (Hincks). Hincks described one pair of marginal spines. My New Zealand specimens have one to three marginal spines on each side, in addition to a spine near the avicularium (Fig. 36 B). This short spine, just distal to the attachment of the avicularium, is rather constantly present in the New Zealand specimens and is shown in Hincks's and Waters's figures, where it appears to be the only spine in addition to the two or three distal ones. It is not shown in MacGillivray's figure in which there is a marginal spine on one or both sides proximal to the avicularium.

The specimens from the Red Sea (15.10.20.4), Suez Canal (26.9.6.134*c*, *d*) and Gorgona (29.4.26.248) differ from these typical specimens in their rather larger zooecia and in the complete absence of marginal spines. The avicularia, particularly of the Gorgona specimen, are less humped dorsally and have a slightly longer beak. The figures show that the specimens from the Cape Verde Islands (Kluge), and St Helena (Marcus) also differ from the typical form in these respects. The specimens recorded by Osburn and Thornely were not figured and I have not seen them, but Osburn mentions that his material from the Tortugas was without marginal spines.

In *B. cupulariensis* (Osburn, 1914, p. 190; Harmer, 1926, p. 419), which shows some resemblance to *B. intermedia*, there is a much more complete series of marginal spines, and the last one on each side is usually directed outwards as in Osburn's fig. 7. The spine beside the avicularium is absent, and the connecting tubes are shorter than in *B. intermedia*.

Klugella gen.n.

GENOTYPE. *Flustra echinata* Kluge, 1914, p. 658, pl. xxxii, fig. 6, text-fig. 38.

DEFINITION. Colony flustrine consisting of broad, irregular lobes, with kenozooecia filling angles between marginal zooecia. Zooecia not forked proximally, or with a mere notch. Distal wall oblique with a group of uniporous septula. Lateral rosette-plates 1–4, in distal half of wall, multiporous. Opesia extensive. No cryptocyst. A small proximal gymnocyst. Avicularium jug-shaped, attached rigidly to proximal gymnocyst, with multiporous rosette plate at base. Rostrum directed transversely. Ovicells hyperstomial, entooecium calcified, ectooecium wholly or partly membranous. Avicularium not fused to ovicell.

REMARKS. The definition of this genus has been framed to include *Flustra crassa* Busk (1884, p. 53; see *Klugella buski*, p. 422) from Kerguelen, which resembles the genotype in its avicularia, and short, more or less spindle-shaped marginal kenozooecia, and in the general structure of its ovicells. It differs in the bilaminar colony and in the absence of any overlapping of the zooecia frontally. The indentation of the basal insertion of the proximal wall (Kluge, text-fig. 38*c*) which appears to be constant in *Klugella echinata* and presumably represents the forked proximal end of the zooecium of many other Bicellariellidae, is absent in *K. buski*. *K. buski* has less numerous rosette-plates, there being only one or two[1] in the distal half of each lateral wall, as compared with three or four in *K. echinata*. *K. buski* also differs in the absence of basal spines and (in the limited material available) of rootlets. Marginal spines are less developed in *K. buski*, but the two pairs of distal ones much resemble the two distal pairs of *K. echinata*. The mandible of the avicularium is shorter in *K. buski* although the spout-like beak is much alike in both species (see Fig. 36 C, Busk's figure being misleading). The ovicells of both species are essentially alike in structure, having a small area of attachment to the distal zooecium, a calcareous entooecium and an ectooecium of which the greater part, at least, is membranous. Those of *K. echinata* are more shallow and, as far as my experience goes, their only sculpture is a faint radial striation.

The boat-shaped zooecia of *K. echinata*, with their row of marginal spines, resemble those of various species of *Beania* and the basal spines are like those of *B. pulchella* (see

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[1] Waters (1896, p. 284) says there are four (i.e. two in the distal half of the lateral wall) and figures one in the distal half. Both numbers are found in the type.

p. 414) and *B. nobilis* (see Hasenbank, 1932, text-fig. 10 B; Hastings, 1939, p. 327). *Klugella* differs from *Beania* in its interzooecial connexions which are not tubular, in its avicularia, those of *Beania* being mobile and attached laterally, and in its marginal kenozooecia.

Dendrobeania differs from *Klugella* in its stalked, mobile avicularia, in the absence of marginal kenozooecia, and the presence of marginal zooecia of distinctive shape, as in *Bugula*, *Bugularia*, etc.

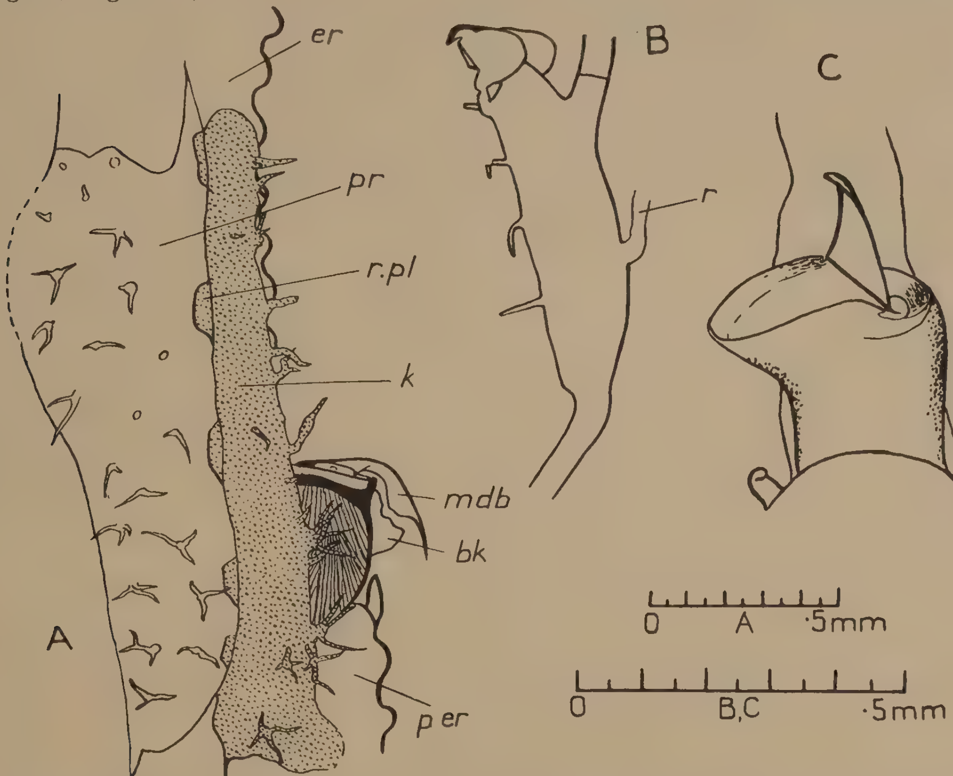

Fig. 36. A. *Klugella echinata* (Kluge). St. TN 316, McMurdo Sound. Basal view of margin of branch showing kenozooecium (stippled). B. *Beania intermedia* Hincks. St. TN 134, New Zealand. One zooecium in side view. C. *Klugella buski* nom.n. 87.12.9.252A. Challenger St. 149D. Kerguelen. Avicularium from the type-specimen with parts of adjoining zooecia.

bk. beak, *er.* erect part of neighbouring zooecium, *k.* kenozooecium, *mdb.* mandible, *p.er.* erect part of proximal zooecium, *pr.* proximal part of neighbouring zooecium, *r.* rootlet, *r.pl.* rosette-plate.

Klugella seems to fit best into the Bicellariellidae as indicated by its resemblance to *Dendrobeania* and *Beania*, in spite of its possession of marginal kenozooecia and, in the genotype, more numerous rosette-plates. Levinsen (1909, p. 122) transferred *K. buski* to the Bicellariellidae, but did not place it generically.

1. **Klugella echinata** (Kluge). Fig. 36 A.

Flustra echinata Kluge, 1914, p. 658, pl. xxxii, fig. 6, text-fig. 38 *a–c*.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Wilhelm II Land (Kluge); Oates Land; Ross Sea (Terra Nova).

Kluge gave a full and accurate description of this species. The branches bear a marginal series of more or less spindle-shaped kenozooecia (Fig. 36 A), lying along the lateral walls of the marginal zooecia and connected with them by a series of rosette-plates which may be prominent as in the figured specimen. The kenozooecia have the effect of filling in the angles between the marginal zooecia which overlap them so that they are rarely visible in frontal view. The kenozooecia bear spinous processes like those on the basal surface of the ordinary zooecia.

Fig. 36 A shows part of the edge of a branch in basal view. The kenozooecium (stippled) lies along the lateral wall of the proximal part (*pr.*) of a marginal zooecium. The lateral wall of the erect distal part of this zooecium (*er.*) is to be seen beyond the the distal end of the kenozooecium and the avicularium belonging to the same zooecium is visible beyond the kenozooecium marginally. The distal and proximal ends of the neighbouring zooecia in the longitudinal series are also visible.

2. **Klugella buski nom.n.** Fig. 36 C.

Flustra crassa Busk, 1884, p. 53, pl. xvi, figs. 6, 6 *a*, *b* (not *F. crassa* Desmarest and Lesueur, 1814, p. 53); Waters, 1896, pp. 281 *et seq.*, pl. i, fig. 22, pl. ii, fig. 5.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Kerguelen (Busk).

HOLOTYPE. Challenger St. 149 D, Kerguelen, 87.12.9.252 A, the holotype of *Flustra crassa* Busk.

The name *Flustra crassa* being preoccupied by *F. crassa* Desmarest and Lesueur I propose the trivial name *buski* for Busk's species which, as explained above, I propose to include in *Klugella*.

As shown by Waters (1896, pl. ii, fig. 5), and in my Fig. 36 C, the avicularium is columnar and attached by a broad base, and has a spout-like beak. Some, but not all, zooecia have the short conical spines on the distal corners, noticed by Busk, and some have in addition a pair of longer spines, placed one on each side, just proximal to the distal spine, and arching over the opesia. The hyperstomial ovicell is longer than wide, with a membranous ectooecium and a calcareous entooecium bearing reticulate sculpture reminiscent of that of *Camptoplites retiformis*. As already mentioned, the angles between the marginal zooecia are filled by more or less spindle-shaped kenozooecia.

Himantozoum Harmer, 1923

1. **Himantozoum antarcticum** (Calvet). Fig. 37 B.

Flustra antarctica Calvet, 1909, p. 11, pl. i, figs. 4–6; Livingstone, 1928, p. 22, pl. iii, fig. 9 (references).

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, Sts. 20, 27, 42, 45, 144, 164, 175, 190, 363, 456, 474, 1872, 1873, 1961, WS 27, WS 33, WS 42, WS 177; Victoria Quadrant, Sts. 1652, 1658, 1660.

GEOGRAPHICAL DISTRIBUTION. South Georgia (Discovery; Shackleton-Rowett Expedition); Bouvet Island; South Sandwich Islands; South Orkney Islands; near Elephant Island (Discovery); South Shetland Islands (Discovery; 20.12.11.1, from 200 fm. on whale harpoon); Palmer Archipelago (Discovery; Calvet); Adelie Land (Livingstone); Wilhelm II Land (Kluge); Oates Land (Terra Nova); Ross Sea (Terra Nova; Discovery).

The affinities of Calvet's species appear to be with the Bicellariellidae rather than the Flustridae. Of the described genera of the family it approaches most closely to *Himantozoum* Harmer (1923, p. 311; 1926, p. 453) with which it agrees in the form of the colony and zooecia, in the method of bifurcation and in the possession of a distinct operculum. It differs in the absence of avicularia and the presence of ovicells, but the ovicells are shallow and, as noticed by Calvet, only accommodate a small part of the embryo. The difference between *H. taurinum* with its internal ovisacs and *H. antarcticum* with shallow ovicells appears unimportant when one considers the great similarity of their zooecial and zoarial characters, especially as *H. sinuosum* and *H. obtusum* sp.n. have rudimentary ovicells of intermediate character.

In comprising species both with and without avicularia, and showing a graded series of ovicells *Himantozoum* would resemble other genera of the Bicellariellidae, particularly *Beania*. There is thus justification for modifying the definition of *Himantozoum*, in these ways. A list of the species that I include in *Himantozoum* is given in the legend to Fig. 63, p. 494.

Bugula versicolor Busk (1884, p. 38) is still excluded from *Himantozoum* by its large endozooecial ovicells, which are very different from the shallow hyperstomial ovicells of *H. antarcticum* and, as suggested by Harmer (1926, p. 454), may relate it to the Farciminariidae. Although they are immersed in autozooecia instead of kenozooecia, they have much in common with the ovicells of *Kenella biseriata* which should, in my opinion, be placed in the Farciminariidae (see p. 394).

There is some variation in the position of the spines on the fertile zooecia in *Himantozoum antarcticum*. They may be directed distally or obliquely inwards, but in this material they seldom have the almost transverse position shown in Calvet's figure. The fine colony from Bransfield Strait has branches with as many as eleven series of zooecia.

A young colony from St. 1660 (Ross Sea, 27 January 1936) consists of an ancestrula and seven zooecia arranged in a single series. The ancestrula is attached by its slightly expanded base, and both the ancestrula and the succeeding zooecia are typical in shape with the opesia occupying the greater part of the frontal surface and the distal corners pointed. Each zooecium gives rise to a rootlet proximally from the lateral wall, and these rootlets adhere to the basal surface of the colony. In six other young colonies from St. 1660, the number of zooecia in the basal uniserial portion of the colony varies from four to nine. The figured ancestrula (Fig. 37 B), which is exactly similar in shape to those from St. 1660, came from St. TN 194 (off Oates Land, 22 February 1911).

The "stalk", mentioned by Harmer (1923, p. 311), is formed by rootlets enveloping the zooecia of the more proximal parts of the colony, as described by Calvet. In some specimens these rootlets are calcified.

Since this report was in proof I have seen a paper by Braem (1940, p. 675) who finds that the alimentary canal of *Bugula apsteini*, which I have included in *Himantozoum*, shows the same peculiarities as the other forms of *Himantozoum* examined by him, namely[1]

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[1] Braem examined material from the Deutschen Tiefsee Expedition. He does not mention varieties or forms, but according to Hasenbank (1932) the expedition did not obtain the typical forms of these two species. The question whether Hasenbank's material of *H. sinuosum* is distinct from the typical form is discussed below.

H. sinuosum (var. *variabilis*?) and *H. leontodon* forma *cornuta*. Braem suggested that the presence of hyperstomial ovicells in *Bugula apsteini* might nevertheless make it necessary to place it in a separate genus, but with my modification of the genus this difficulty does not arise.

I have examined the type-specimens of *H. mirabile* (87.12.9.182), *H. margaritiferum* (87.12.9.200) and *H. leontodon* (87.12.9.177). In all of these, and particularly the first two, the tentacles are very long and the other parts of the polypide are much reduced as described by Braem. No caecum is discernible in a whole mount and the pharynx is slender.

In *H. antarcticum* and *H. obtusum*, on the other hand, the gut is well developed and has a quite conspicuous caecum and a rotund pharynx. Braem described the peculiarities of his species in comparison with *Bugula neritina*. I have compared spirit-preserved specimens of *Himantozoum antarcticum* from St. 474 and of *Bugula neritina* from the Suez Canal (26.9.6.133f). These were decalcified and mounted whole, the *Himantozoum* being stained with borax carmine, the pigmentation of the *Bugula* sufficing without staining. Fully grown polypides in similar positions were compared, and no significant or constant difference in size, shape or proportion of parts was observed.

In the type-specimen of *H. sinuosum* (87.12.9.179) the whole polypide is longer and more slender than in *H. antarcticum*, the tentacles are relatively longer, and a caecum is not discernible, but the rest of the alimentary canal is quite well developed. *H. sinuosum*, which apparently ranges from 146 m. to 3397 m., is thus more or less intermediate between the abyssal forms and the two relatively shallow-water species, *H. antarcticum* and *H. sinuosum*.

2. **Himantozoum obtusum** sp.n. Fig. 37 A, C.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. WS 85, WS 93, WS 225, WS 228, WS 229, WS 231, WS 246, WS 249, WS 783, WS 871.

GEOGRAPHICAL DISTRIBUTION. Patagonian Shelf (Discovery); off Patagonian Shelf down to 1098 m. (Discovery; 34.11.12.12 from Challenger St. 320).

HOLOTYPE. St. WS 228, off Patagonian Shelf.

DESCRIPTION. *Colony* usually bi- or triserial. Uniserial at base and occasionally quadriserial before a bifurcation. Bifurcation as in other species of *Himantozoum*.

Rootlets as in *H. antarcticum*.

Zooecia like those of *H. antarcticum* except that they are smaller and are rounded distally, without angles or spines (Fig. 37 A). "Tubulure" (of Calvet) present.

Avicularia absent.

Ovicells on median zooecia very shallow, without associated spines (Fig. 37 A, C). Embryo develops in large sac in body cavity.

REMARKS. This species, which is confined to the Patagonian region, is very similar to *H. antarcticum*. In addition to its more slender colony, and the differences already noted in the zooecia and ovicells, there appears to be a slight difference in the shape of the opercula, those of *H. antarcticum* being more angular, their shape corresponding to the shape of the distal end of the zooecium. In *H. obtusum* the opercula of the fertile zooecia are a little longer and rounder than the others. The Challenger specimen was found among unnamed material.

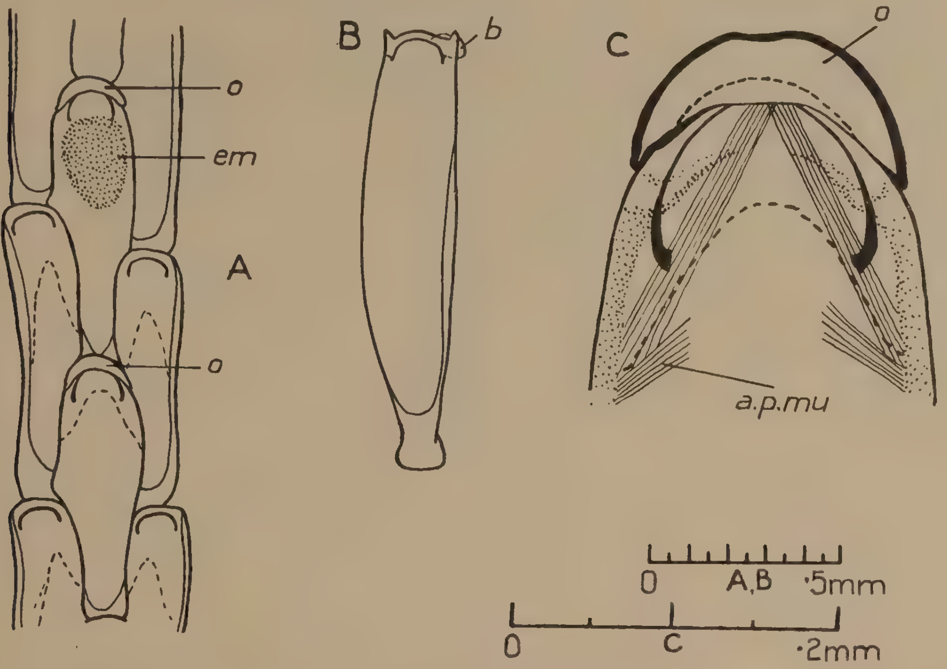

Fig. 37. A, C. *Himantozoum obtusum* sp.n. St. WS 228, off Patagonian Shelf. In Fig. C, showing an ovicell and the distal part of the fertile zooecium, the dotted lines indicate the frontal and basal limits of the oblique distal wall. The distribution of the funicular tissue (stippled) is related to the position of the embryo sac. B. *H. antarcticum* (Calvet). St. TN 194, off Oates Land. Ancestrula.

a.p.mu. anterior bundle of parietal muscles, *b.* first bud, *em.* embryo, *o.* ovicell.

3. Himantozoum sinuosum (Busk).

Bugula sinuosa Busk, 1884, p. 39, pl. x, fig. 2.

Himantozoum sinuosum Harmer, 1923, p. 312; 1926, p. 453.

Bugula sinuosa var. *variabilis* (part) Kluge, 1914, p. 632, text-fig. 19 *a* (? pl. xxviii, fig. 6, not text-fig. 19 *b*).

? *Bugula sinuosa* var. *variabilis* Hasenbank, 1932, p. 332, text-fig. 7.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Prince Edward Island (Busk); Kerguelen (34.11.12.24, 25, Challenger Coll.); Southern Ocean, 3397 m. (Kluge); off East Africa? 1668 m. (Hasenbank).

In the type-specimen from Prince Edward Island (87.12.9.179) many of the zooecia of the inner rows are fertile. The ovicell forms a very shallow cap, the edges of its two layers being all that is visible in frontal view. It occupies the full width of the distal end of the zooecium between the pointed distal corners. In the inner series pointed corners are only present on fertile zooecia, the non-fertile zooecia having a rounded end. Busk's figure (pl. x, fig. 2a) shows five fertile zooecia and one non-fertile zooecium in the inner series. The fertile zooecia have probably been overlooked hitherto because reproduction is at an early stage and in most instances the only evidence that a zooecium is fertile is the very inconspicuous ovicell and the presence of a small ovary similar to that described in *Himantozoum taurinum* by Harmer (1926, p. 455).

In describing *H. sinuosum* var. *variabilis* Kluge explained that he had insufficient material for comparison, and he made it clear that his treatment, as one variable variety, of the two forms recognizable in his material was tentative.

He gave three figures to illustrate the two extreme forms and an intermediate specimen. The first (text-fig. 19 *a*) only differs from Busk's figure of the typical form in the rounded ends of the zooecia of the inner rows, and it is clear from what I have said above that it is not to be distinguished from the typical form, the round-ended zooecia corresponding very closely with the non-fertile zooecia of the type.

The intermediate specimen (Kluge, 1914, pl. xxviii, fig. 6) has zooecia, with strongly arched ends and rather more sharply pointed corners, which might well be fertile. It much resembles the specimen figured by Hasenbank (1932, text-fig. 7) and they both have avicularia on zooecia of the inner as well as the outer series. It seems possible that these should likewise not be distinguished from the type. On the other hand, Braem's observations, discussed above, suggest that Hasenbank's specimens may have differed from the typical form in their alimentary canal.

Kluge described reduced ovicells in his variety which appear to have been similar to those now described in the typical form, but he did not say whether he had observed them in both forms of the variety. Hasenbank did not find ovicells in his specimens, although he observed fertile zooecia. As the ovicell is very inconspicuous and Hasenbank's figured fertile zooecia are similar in shape to those of the type, I am, however, not convinced that ovicells were not present.

If Kluge's intermediate specimen proved to belong to the typical form, the extreme form shown in his text-fig. 19 *b*, which is rather markedly different from the other figured specimens, would remain alone in var. *variabilis*.

4. **Himantozoum sinuosum var. variabilis** (Kluge).

Bugula sinuosa var. *variabilis* (part) Kluge, 1914, p. 632, text-fig. 19 *b*.

Himantozoum sinuosum var. *variabilis* Harmer, 1923, p. 312.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Southern Ocean, 3397 m. (Kluge).

I have seen no specimen of this variety, which is discussed under *Himantozoum sinuosum*.

Bugula Oken, 1815

1. **Bugula calathus** Norman.

Bugula calathus Norman, 1868, p. 218, pl. vi, figs. 3–8; Kluge, 1914, p. 636, text-fig. 22 (references); Barroso, 1922, p. 94; Neviani, 1939, p. 18.

Bugula flabellata Hasenbank, 1932, p. 330, text-fig. 5 A; O'Donoghue and de Watteville, 1935, p. 208.

? not *Bugula calathus* Kluge, 1908, p. 518.

Station distribution. *South Africa:* Sts. 91, MS 82.

Geographical distribution. South-west Britain (Norman; Hincks); Mediterranean (Waters; Vigelius; Hincks; Calvet; Barroso; Neviani); South Africa (Kluge; Hasenbank; O'Donoghue & de Watteville; Discovery; 96.8.4.5, 7).

The frequent confusion between *Bugula calathus* and *B. flabellata* is due, in part at least, to an error in Hincks's *British Marine Polyzoa*, by which some of the figures on pl. xi were wrongly attributed in the text (1880, pp. 80, 82). The right attribution is given in the explanation of the plate: figs. 1–4 *B. flabellata*, figs. 5–8 *B. calathus*. The chief points of distinction are shown by Hincks, namely, the characters of the colony, the appearance of the zooecia in basal view, and the shape of the avicularia. The sharply down-turned beak of the avicularium of *B. flabellata* is particularly characteristic.

In view of its isolation from the other recorded localities, and the existence in the Arctic of other species that might be confused with *B. calathus*, I agree with Nordgaard (1918, p. 24) and Borg (1933, p. 528) that Kluge's record of *B. calathus* in the White Sea is doubtful.

Specimens from Waters's Naples collection (97.5.1.363, 364) confirm the identity of *B. avicularia* forma *flabellata* Waters (1879, p. 117) with *B. calathus*.

The South African specimen, recorded by O'Donoghue and de Watteville (1935, p. 208) as *B. flabellata* (1936.4.2.1), belongs to *B. calathus*, and it is evident from the figure given by Hasenbank (1932, p. 330) that he also had *B. calathus* before him. The specimen from O'Donoghue and de Watteville's collection shows the radial striation of the ovicell figured by Hasenbank.

True *B. flabellata* has not so far been proved to extend as far south as South Africa. In the absence of any other evidence that the species is found at the Cape, and in view of its frequent confusion with other species, I agree with Marcus (1920, p. 72) that Kirchenpauer's frequently quoted record (Hincks, 1880, p. 81) was probably erroneous. The geographical range of the species is, however, more extensive than Marcus then supposed, for he has since (1938*a*, p. 27) recorded it from Brazil, a region from which it is also represented in the British Museum (27.2.16.1).

The Discovery specimen of *B. calathus* shows the formation of new shoots from ancestrula-like zooecia budded from the outer distal corner of old zooecia as described below under *B. dentata* and *B. cucullata* var. *cuspidata*.

2. **Bugula cucullata var. cuspidata var.n.** Fig. 38 A–C.

Station distribution. *New Zealand:* St. 935.

Geographical distribution. New Zealand (St. TN 144; Discovery; 55.12.7.195).

Holotype. St. TN 144.

These New Zealand colonies differ from the Australian specimens of typical *Bugula cucullata* Busk (1867, p. 241) in their avicularia, ovicells and spines, and appear to represent a distinct variety. The avicularia, which are present on nearly every zooecium, are larger and more distally placed (Fig. 38 A). They have a convex or flattened upper profile with no concavity (cf. the avicularium of typical *B. cucullata* figured by Harmer, 1926, pl. xxxii, fig. 20), and there is a cusp on each side of the beak. The mandible has a pair of basal processes, not seen in typical *B. cucullata*. The ovicell is smaller and more cap-like (Fig. 38 B), and the spines are comparatively slender and of uniform width, in contrast to the tapering, and often stout, spikes of the Australian specimens. When the two outer spines are of different size it is the distal one that is larger in Australian specimens, and the proximal one in var. *cuspidata*.

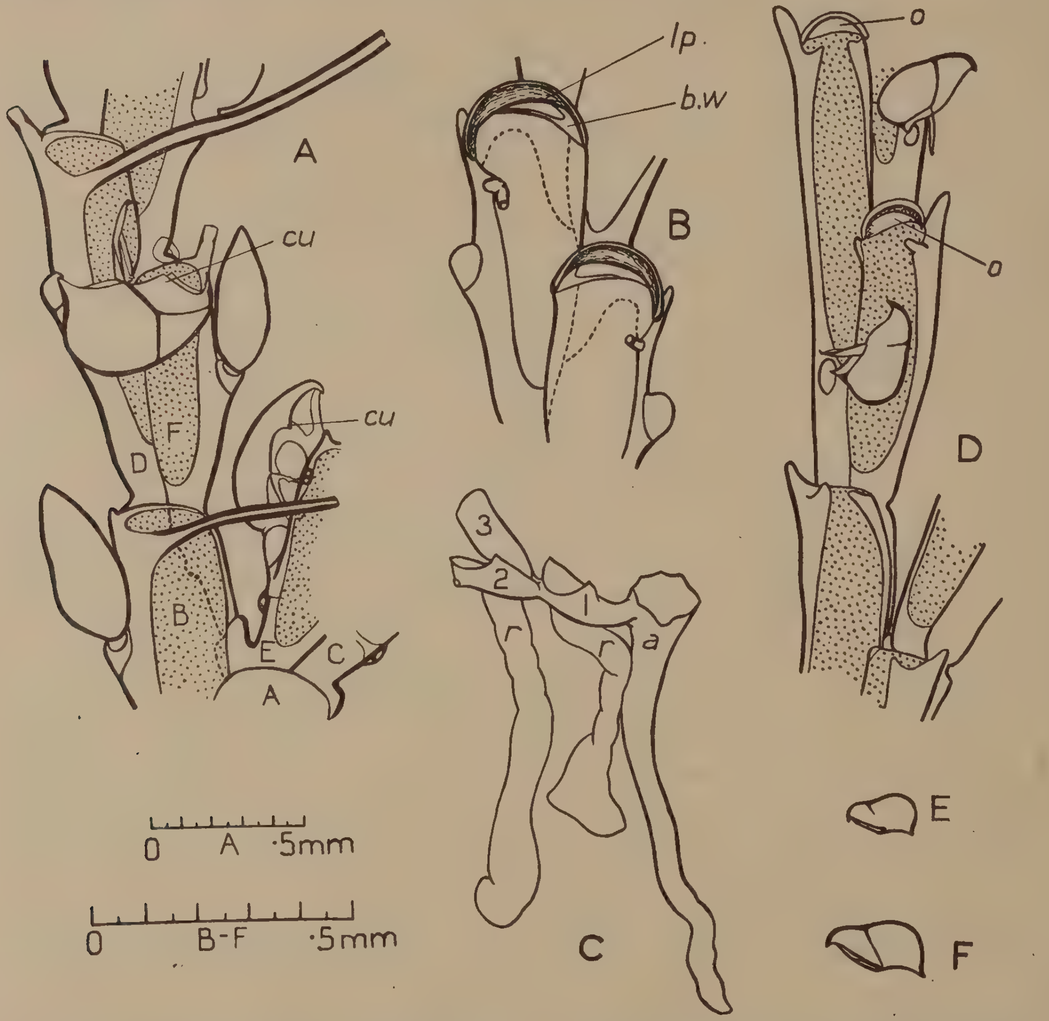

Fig. 38. A–C. *Bugula cucullata* var. *cuspidata* var.n. St. TN 144, New Zealand. A. Bifurcation lettered according to Harmer's scheme. The apparent joint in zooecia *CE* is probably an injury. B. Fertile zooecia. C. Young colony with ancestrula, drawn from dry specimen. D. *Bugula hyadesi* Jullien, 34.11.12.41. Challenger St. 315. E. *Bugula turrita* Verrill, 98.5.7.140. North-east America. Avicularium. F. *Bugula ditrupae* Busk. 99.7.1.1014. Madeira. Avicularium from a paratype-specimen. *a.* ancestrula, *b.w.* basal wall of ovicell, *cu.* cusp, *lp.* lip of ovicell, *o.* ovicell, *r.* rootlet, 1–3, first three zooecia.

In both the typical form and the variety the outer distal corner of the zooecium is inrolled so that the proximal spine is directed more or less frontally. The Siboga material (Harmer, 1926, p. 447) has little or no inrolling of the corner, and the spines are both directed distally.

All these colonies of var. *cuspidata* have stout, usually annulate, rootlets, springing from the basal surface of the zooecia and passing, independently of each other and of the zooecia, to the substratum. In one of the Terra Nova colonies the branches spread fanwise above the surface of a *Cellepora* and drop these rootlets at such frequent intervals that they form a forest of rootlets. These rootlets are thickest at the end farthest from the colony. This colony has a very long, slender, turbinate ancestrula (Fig. 38 C). From the shape of its opesia it appears that it had spines all round it. It is very similar to that of typical *Bugula cucullata* figured by Harmer (1926, pl. xxx, fig. 7). The rootlets on the first two zooecia show little trace of the annulation which is such a marked feature of those, often longer, ones, that were formed subsequently. The main part of the colony is opaque, spineless and without avicularia. Here and there ancestrula-like zooecia have been budded from these presumably old zooecia and have given rise to fan-shaped, glistening shoots, with spines and avicularia. A similar budding process was seen in *B. calathus* and *B. dentata*.

3. **Bugula dentata** (Lamouroux).

Acamarchis dentata Lamouroux, 1816, p. 135, pl. iii, figs. 3 *a*, B.

Bugula dentata Harmer, 1926, p. 439, pls. xxx, figs. 5, 6, xxxii, figs. 21–25 (references); Livingstone, 1929, p. 53; Hasenbank, 1932, p. 329; Okada, 1934, p. 5, pl. i, fig. 9.

STATION DISTRIBUTION. *Cape Verde Islands:* St. 299.

GEOGRAPHICAL DISTRIBUTION. Madeira (Norman); Cape Verde Islands (Waters; Discovery); John Adams Bank, off Brazil (99.7.1.4618); South Africa (Krauss; Busk; Hasenbank; O'Donoghue; Harmer); Red Sea (27.5.23.1); Indian Ocean (Thornely); Amsterdam Island, Indian Ocean (Hasenbank); Malay Archipelago (Calvet; Marcus; Harmer); Australia (Lamouroux; Busk; MacGillivray; Waters; Kirkpatrick; Harmer); Tasmania (Busk); New Zealand (Busk; Livingstone); Japan (Ortmann; Yanagi and Okada; Marcus; Okada); Loyalty Islands (Philipps).

In the zooecia of this specimen the opesia is shorter than that described by Harmer, and the avicularium, which is as usual on the outer side of the zooecium, is attached at a point proximal to, or sometimes level with, the proximal end of the opesia. Such a condition is seen in parts, particularly the proximal part, of quite typical colonies (e.g. the specimen from Siboga St. 50, 28.3.6.280), and it is possible that the small colony obtained by the 'Discovery' would have produced zooecia with the longer opesia if it had developed further. Ovicells and enlarged trifoliate avicularia are absent from this specimen, and the spines are slender and without any distinct basal joint. The main colony is about 10 mm. long and complete basally, with ancestrula and basal tuft of rootlets. The older zooecia contain brown bodies and from this part of the colony spring eight adventitious branches each of which starts with an ancestrula-like individual and shows the usual gradual transition to zooecia of typical form. Each adventitious branch springs, apparently as a bud, from the distal part of the outer lateral wall of a zooecium, i.e. from the inrolled corner below the insertion of the spines (cf. *B. calathus* and *B. cucullata* var. *cuspidata*).

4. Bugula hyadesi Jullien. Fig. 38 D.

Bugula hyadesi Jullien, 1888, p. 71, pl. vii, figs. 4–6; Calvet, 1904, p. 8.
? *Acamarchis brasiliensis* d'Orbigny, 1841, pl. iii, figs. 5–8; 1847, p. 10.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Magellanic Region (Jullien; Calvet); Falkland Islands (34.11.12.41 from Challenger St. 315); Rio de Janeiro ? (d'Orbigny).

A small specimen of this species found among unnamed material from Challenger St. 315 has very small cap-shaped ovicells (Fig. 38 D). Such an ovicell is evidently represented on one zooecium of the right-hand branch in Jullien's fig. 5.

Bugula hyadesi is distinguished from *B. ditrupae* (Fig. 38 F) by its less numerous distal spines (2 : 1 instead of 3 or 4 : 2); by its reduced ovicells; by its larger avicularia which are attached more proximally and have a more acute upper head-angle (see p. 396) and an almost rectangular lower head-angle; by its more delicate colony, with bifurcations of type 3, those of *B. ditrupae* being of type 5.

B. hyadesi appears to be related to *B. turrita* (see Fig. 38 E, and Osburn, 1912, p. 225) with which it agrees in the general shape of its zooecia and in its method of bifurcation. *B. hyadesi* is a more delicate species with bigger avicularia in which the beak forms a larger proportion of the total length. The avicularia are attached more proximally. The small, cap-like ovicell is quite unlike the globose ovicell of *B. turrita*.

Jullien found *B. hyadesi* on fronds of *Macrocystis* from the region of Cape Horn, and Calvet records a similar habitat. It seems probable that it is a synonym of *Acamarchis brasiliensis* d'Orbigny which was found on *Sargassum* off the coast of Brazil, where it was rare. D'Orbigny's fig. 5, which is natural size, represents a delicate species, similar to *Bugula hyadesi*, and figs. 7 and 8 show bifurcations of type 3, and long zooecia agreeing very exactly with those of *B. hyadesi*. In view of the small size of the ovicells it is not to be expected that d'Orbigny should have detected them with the instruments at his disposal and, though the avicularia seem to us conspicuous, Waters (1905*b*, p. 6) has shown that a large one was overlooked by d'Orbigny in *Acamarchis multiserialis*.

5. Bugula neritina (Linnaeus).

Sertularia neritina Linnaeus, 1758, p. 815.
Bugula neritina Marcus, 1937, p. 66, pl. xiii, fig. 34 (references); Neviani, 1939, p. 18; Hastings, 1939, p. 336.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. East and west temperate Atlantic (including Britain at Plymouth and Falmouth); east and west tropical Atlantic; Mediterranean; Suez Canal; Red Sea; Indian Ocean; Cape of Good Hope; Australia (west, south and east); Tasmania; Auckland Islands; New Zealand; Japan; California; Balboa; Galapagos Islands; Valparaiso; Falkland Islands.

The collection lent me by the U.S. National Museum included a specimen of *Bugula neritina* from Port William, Falkland Islands. The species is not otherwise known from the Falkland region, as far as I am aware, and was probably introduced to the port by shipping (see Marcus, p. 67). As the sources of all the other recorded localities can be found through the references given by Marcus, I have not included them in my statement of distribution.

6. **Bugula longissima Busk.** Fig. 39 C, D.

Bugula longissima Busk, 1884, p. 42, pl. xxxi, fig. 7 *a*, *b*, *c*.

STATION DISTRIBUTION. *Antarctic:* Victoria Quadrant, St. 1660.

GEOGRAPHICAL DISTRIBUTION. Kerguelen; Heard Island (Busk); Ross Sea (Terra Nova; Discovery).

The colonies are rather large and straggling as compared with the more bushy colonies of the Challenger material. The Terra Nova colony (which is unfortunately completely decalcified) is 14 cm. long. Otherwise these specimens agree with the type.

The terminal branches are very delicate and transparent, slightly calcified and colourless, and are in striking contrast to the more proximal portions of the colonies, which consist of yellow horny zooecia, surrounded by rootlets. In the Terra Nova specimen the greater part of the colony consists of branching, cable-like stems formed by rootlets surrounding zooecia in this way.

The bifurcation is of type 4 (Harmer, 1926, p. 433), but is exceptional in that zooecia *E* and *F* are forked proximally like the rest of the zooecia, instead of coming to a single point (see Fig. 39 C, drawn from type-specimen). The connecting process, given off by zooecium *F* and joining the inner half of the forked end of *G*, is long and tubular, and is connected to the adjacent zooecium *E* by prominent rosette-plates. It thus looks like one of the runners of *Camptoplites*, although its morphological relations show it to be a connecting process.

The zooecia vary in length within the colony, and the "conical process" on the outer distal corner of the zooecium is not always present.

The ovicell is delicately calcified. The entooecium has a rather prominent median longitudinal ridge or suture and bears faint radial striations (Fig. 39 D), which are presumably the feature for which Busk used the expression "engine-turned". The ectooecium is considerably larger than the entooecium and is uncalcified frontally. The edge of the calcified hood-like part of the ectooecium is seen in some views as a point and led Busk to describe the ovicell as acuminate.

Bugula lophodendron, compared by Ortmann (1889, p. 24) to *B. longissima*, appears from his figure to have a bifurcation of type 3.

Yanagi and Okada (1918, p. 423) put *B. longissima* in the synonymy of *B. johnstonae* Gray. It is, however, markedly distinct from true *B. johnstonae* and from *B. longicauda* which may be the species identified as *B. johnstonae* by Yanagi and Okada (see Harmer, 1926, p. 450).

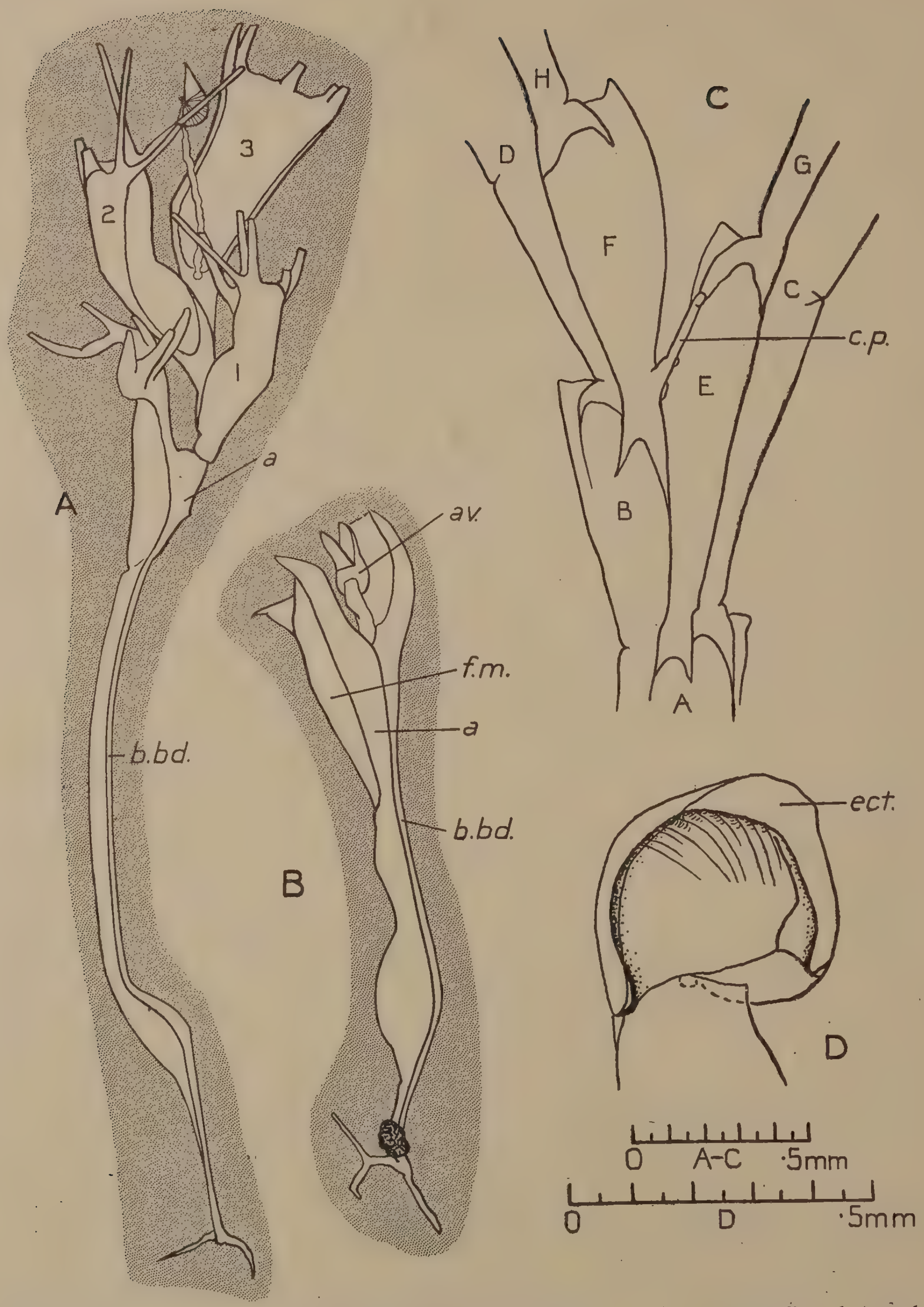

Fig. 39. A. *Camptoplites.* Ancestrula, species 7. St. TN 194, off Oates Land. B. *Camptoplites.* Ancestrula, species 1. St. 1652, Ross Sea. Attached Foraminiferan hides part of proximal portion. C. *Bugula longissima* Busk. 87.12.9.204. Challenger St. 151, Heard Island. Basal view of bifurcation of holotype. Zooecia lettered according to Harmer's scheme. D. *B. longissima* Busk. St. 1660, Ross Sea. Ovicell. *a.* ancestrula, *av.* avicularium, *b.bd.* basal band, *c.p.* connecting process, *ect.* edge of calcareous part of ectooecium, *f.m.* frontal membrane, 1–3, first three zooecia.

Caulibugula Verrill, 1900

1. **Caulibugula tuberosa Hastings.**

Caulibugula tuberosa Hastings, 1939, p. 340, text-figs. 279 A–C.

STATION DISTRIBUTION. *New Zealand:* St. 934.

GEOGRAPHICAL DISTRIBUTION. New Zealand (Hastings).

Kinetoskias Daniellsen, 1868

1. **Kinetoskias pocillum Busk.**

Kinetoskias pocillum Busk, 1881, p. 7, pl. i, figs. 2, 5; 1884, p. 45, pl. viii, fig. 2; Harmer, 1926, p. 468.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Off Valparaiso, 3953 m.; off Brazil, 58·6–732 m. (Busk).

Camptoplites Harmer, 1923

GENERAL. *Camptoplites* was introduced by Harmer (1923, p. 300) and redefined by him (1926, p. 452). The abundant material before me suggests one modification of the definition. I do not think the zoarium is usually stalked. The stalk of *C. lunatus* consists of a bundle of the axillary rootlets, which are applied to the basal surface of the branch and so run together throughout their length. In the other species the axillary rootlets are free from the surface of the zoarium, and are attached singly to the substratum, and it is clear that a stalk, if present, would have to be formed in a different way from that of *C. lunatus*. Ancestrulae of several species are known (Figs. 39 A, B, 40, 41 A, B, 42 A, D). They agree in having a tubular proximal portion, ending in root-like structures by which the ancestrula is attached (see p. 437). As the growth of the colony proceeds this attachment is supplemented by axillary or marginal rootlets which pass to the substratum quite independently of the ancestrula, of the zooecia, and of each other (Figs. 41 A, 42 D). There is nothing in any of these instances to suggest that a stalk would subsequently have been formed. On the other hand, it is easy to imagine the delicate ancestrula, and probably also some of the other basal zooecia, breaking away leaving the colony attached by a number of independent rootlets, just as all the adult colonies (except that of *C. lunatus*) examined by me have been. It is hard to believe that if a stalk were characteristic of the genus no trace of it would have been found in my material.

In 1926 Harmer added to his earlier definition the statement that the connecting process at a bifurcation gives off two distal branches and a rootlet (e.g. Fig. 52 A). Examination of the Antarctic material shows that the constant feature is not the formation of the two distal branches or runners (though these are present at some or all bifurcations in the majority of the species), but the separation of the connecting process itself,[1] at least in those bifurcations that have produced an axillary rootlet, as a separate chamber from which the rootlet originates when present (Fig. 46 B). The axillary chamber can usually be seen to be connected with one of the neighbouring zooecia by a conspicuous rosette-plate (e.g. the large one on the left in Fig. 47 H). In most species the rootlet grows symmetrically and from the basal surface, but in *C. reticulatus*,

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[1] Compare *Bugula longissima* Busk (p. 431 above).

C. areolatus (Fig. 54 A) and *C. rectilinearis* (Fig. 52 A) it is frontal, and in *C. asymmetricus* asymmetrical. Runners have not been seen in typical *C. bicornis*, *C. bicornis* var. *compacta*, or *C. tricornis* (Fig. 46 B). Where there is no rootlet the chamber is usually inconspicuous or absent, but in *C. retiformis* (Fig. 47 H), *C. latus*, *C. atlanticus* and *C. rectilinearis* a well-developed axillary chamber with runners is present whether there is a rootlet or not, and in *C. angustus* (Plate XII, fig. 3) the axillary chambers give rise to secondary branches (see p. 436), axillary rootlets being rarely formed. The formation of axillary secondary branches is occasionally seen in most forms possessing lateral secondary branches, but is not usual except in *C. angustus*.

The lateral rootlets also originate from chambers (e.g. Fig. 51 D). Except in *C. tricornis* (see Fig. 46 C and p. 451) and some young colonies (p. 441) these are placed basally and laterally in the angle between the narrow proximal end of one zooecium and the wider distal end of the preceding one (Figs. 47 I, J, 51 D). The secondary branches arise from these chambers, and a single chamber may produce both a rootlet and a secondary branch. In *C. giganteus*, *C. lewaldi*, *C. angustus*, *C. retiformis*, *C. latus*, *C. atlanticus*, *C. rectilinearis* and *C. reticulatus* the lateral chamber forms a runner (Fig. 47 I, J). In *C. tricornis* the chamber is prolonged distally but tapers gradually, no part of it being recognizable as a tubular runner (Fig. 46 C).

These arrangements are not peculiar to *Camptoplites*, for in a specimen of *Bugula* (*Dendrobeania*) *birostrata* Yanagi and Okada (1918, p. 420) from Misaki (21.11.7.3, 500–600 fm.) the rootlets forming cross-connexions (cf. Silén, 1938, p. 237) arise from chambers with runners, like those of *Camptoplites*. The chamber figured by Yanagi and Okada has a mere protuberance in the position of the runner, but in the British Museum specimen runners are well formed.

The statement that the operculum is differentiated in *Camptoplites* is true, but perhaps misleading. An arc marking its edge can be seen in many zooecia, but it is very faint, far less distinct than that of *Cornucopina* for instance, and in many zooecia it cannot be detected at all.

AVICULARIA. The avicularia of *Camptoplites* are remarkable for their frequent profusion, diversity of form and length of stalk. The youngest stalks contain much tissue, and do not collapse or contract in preservation. In older stalks this tissue gradually disappears, and these may either contract longitudinally, when preserved, producing fine transverse striations as seen by Busk (1884, p. 41) and Calvet (1909, p. 9), or they may collapse and become crumpled, as described by Harmer (1926, p. 453). Part of a stalk may collapse while another part of the same stalk contracts (see for example *C. bicornis* var. *quadriavicularis*, slide 267 B^4 from St. 160). Contracted stalks give a strong superficial impression of muscular action, but specially preserved material would probably be necessary to settle, in such instances, whether contractile tissues were present, as stated by Busk and Calvet. Harmer did not find muscles in the avicularian stalks of *C. lunatus*, and throughout the genus the stalks of many apparently healthy avicularia contain little or no tissue of any kind. It is thus clear that musculature in the stalk cannot play an essential part in the functioning of these avicularia. All these questions may have to wait until living material can be observed.

A finger-shaped organ (cf. Marcus, 1939, p. 201) is highly developed in many of these avicularia (see Busk, 1884, p. 41, and my Figs. 43 D, F, J, 45 G).

In describing avicularia, the word "head" has been used in the past both for the muscle-chamber, as opposed to the rostrum or beak, and in a more general sense to cover the whole head including the beak (as, for example, in Kluge's terms long-headed and short-headed avicularia). I do not consider these two senses likely to lead to confusion and have continued to use both.

Typical bird's-head avicularia in which head and beak are more or less clearly distinguishable are present in *C. bicornis*, *C. lewaldi* and *C. giganteus*. They are of two kinds. In the larger kind the lower edge of the beak is curved to form a down-turned point (Figs. 43 D, F, J, 45 G). In the smaller kind the lower edge is straight (Fig. 43 C, K). These are the large and small long-headed avicularia of Kluge.

The other avicularia of *Camptoplites* have no clear demarcation of beak from head. They differ in size, in the curvature of the upper surface in profile, and in the relative lengths of the planes of the opesial and mandibular surfaces, and the angle between them. There are large, hook-shaped avicularia in which the two planes form an angle on the under surface of considerably less than 180° (Figs. 42 B, 46 D, 47 A, B, C, E, G, 48 D, 49 E, F, 52 B, 55 A, C, E, G) and smaller ones in which the under surface is almost or quite flat (Figs. 41 C, 42 C, 46 E, 47 D, F, 48 E, F, 51 B, 52 C, 55 B, D, F, H). These two types are widely distributed in the *C. reticulatus* group, defined below (p. 436), and are also found in *C. tricornis* and *C. angustus*.

The round-headed avicularia ("kurzköpfige avicularien" of Kluge), found with the long-headed forms in *C. bicornis*, *C. lewaldi* and *C. giganteus*, are only distinguished from the small, flat-surfaced type, just described, by their larger and stronger build and nearly circular outline. The whole head is at least as high as long (Fig. 43 A, B, G, H, M, N).

A curious point to be noticed in Kluge's figures, which is confirmed by examination of the present material, is that the oblique calcareous thickening, found at the junction of beak and head in the avicularia of *Bugula*, is usually absent in *Camptoplites*, but is present in the long-headed avicularia, both large and small, of *C. lewaldi* (Fig. 45 G) and *C. giganteus* (Fig. 43 J, K). It is also present in the small long-headed avicularia of *C. bicornis* var. *quadriavicularis* (Fig. 43 C), and sometimes in the large long-headed ones of that variety.

In both *C. giganteus* and *C. bicornis* var. *quadriavicularis* a few large round-headed avicularia have been seen at an early stage of development. The head is oval and clearly marked off from the stalk, and, before any calcification appears, contains much tissue, in which a cavity with narrow lumen and epithelial walls can sometimes be seen.

The presence of two avicularia on a single zooecium was noticed in *C. bicornis* and *C. reticulatus* var. *unicornis* by Harmer (1926, p. 452). Instances of this can be seen in several of Kluge's figures, and in all the species examined by me, except *C. lunatus* and *C. atlanticus*. The exceptions may perhaps be connected with the presence of only one kind of avicularium in these species, a supposition supported by the fact that the two avicularia on any one zooecium are usually of different kinds. Two of one kind have, however, been seen in *C. asymmetricus* and *C. latus* var. *aspera*. I have never seen three avicularia on a single zooecium, as shown in Kluge's pl. xxviii, fig. 5.

The avicularia are attached to the proximal gymnocyst. One is always near the proximal border of the opesia, the other may be in close proximity to it (see scars in Kluge's pl. xxviii, figs. 3, 4 and 5, and my Figs. 49 D, 52 A, 54 B, C, D), or in a more proximal position (Kluge, pl. xxix, figs. 3 and 4, and my Fig. 44 A).

THE TWO GROUPS OF SPECIES OF *CAMPTOPLITES*. The species of *Camptoplites* form two groups; one characterized by the presence of large, erect hyperstomial ovicells (pl. v, figs. 3, 4 and Figs. 48 A–C, 49 A, B, C, 50 A, B, C, 51 C, 52 A, D, 53 A–D, 54 B, D) and the absence of secondary branches (short-celled branches, Waters, 1904, p. 21; rameaux secondaires, Calvet, 1909, p. 9; nebenäste, Kluge, 1914, p. 619); and the other characterized by the presence of secondary branches (e.g. pl. vi, figs. 1, 2; pl. vii, figs. 1–4; pl. viii, figs. 1, 3) and by the shallower ovicells, which are tilted backwards (Fig. 46 A), and may be a mere cap to the zooecium (Figs. 44 B–E, 45 A–F). The first, or *C. reticulatus* group, comprises *C. reticulatus*, *C. lunatus*, *C. retiformis*, *C. latus*, *C. atlanticus*, *C. rectilinearis*, *C. areolatus* and *C. asymmetricus*. The second, or *C. bicornis* group, comprises *C. bicornis*, *C. lewaldi*, *C. giganteus*, *C. angustus* and *C. tricornis*.[1] As far as its characters are known *C. abyssicolus* also comes into this group.

In both groups the lateral rootlets generally form connexions from branch to branch, while the axillary ones attach the colony to the substratum, so that where lateral rootlets are common, as in the species of the *reticulatus* group, the colony has a reticulate structure. In the *bicornis* group lateral rootlets may be abundant in the older part of the colony, but the branches are usually free distally, except in the specimen of *C. bicornis* var. *quadriavicularis* from St. WS 871 which is reticulate, and in some specimens of *C. tricornis*, which are matted.

In the species of the *reticulatus* group the appearance of the ovicell commonly changes with age, the primary radial sculpture being gradually overlaid by various types of reticulation or punctation (e.g. Fig. 48, A, B). It is therefore important, in describing ovicells of this group, to look for colonies in which a series of ovicells at different stages can be examined. It is also important that balsam preparations should be made, if the details of these changes are to be seen clearly.

The sculpture of the ovicells of the species of the *bicornis* group does not appear to change with age. In the reduction of the ovicells the species form a graded series from *C. angustus* (Fig. 46 A) in which they are tilted backwards, but are only a little smaller than those of the *reticulatus* group, through *C. abyssicolus* (Kluge, 1914, text-fig. 18), *C. tricornis* (Kluge, pl. xxix, fig. 6 and text-fig. 12*a*), *C. giganteus* (Fig. 45 E, F) and *C. lewaldi* (Fig. 45 C, D), to the varieties of *C. bicornis* (Figs. 44 B–E, 45 A, B, and Kluge, text-fig. 7*c*). The ovicells of the varieties of *C. bicornis* are not only much smaller in total size, but show nothing except their lip in frontal view. Those of typical *C. bicornis* are unknown.

ANCESTRULAE. The Discovery collection comprises a number of young colonies of *Camptoplites* with ancestrulae. The ancestrulae are all of the same general pattern, being more or less vase-shaped and tapering to a narrow stalk which bifurcates on the substratum to form two main attaching rootlets (Figs. 39 A, B, 40, 41 A, B, 42 A, D). These rootlets may be further branched. The first zooecium springs from the ancestrula near the distal end but is continued down the basal surface of the ancestrula by a structure that I have called the basal band (*b.bd.* in figures).

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[1] See Addendum, p. 501.

Within this general plan the ancestrulae show differences in the length and shape of both the stalk and the opesia, and in the number of spines, by which seven species appear to be recognizable. Species **1** and **7** (Fig. 39 A, B) resemble each other, and differ rather markedly from the others in the shape of the ancestrula. Species **2** (Fig. 40) has no spines at all, and an ancestrula of rather different shape from any of the others. Species **3–6** (Figs. 41 A, B, 42 A, D) have ancestrulae of similar shape and are chiefly distinguished by the distribution of spines on the ancestrula and succeeding zooecia (see Table 2). A key for the discrimination of the species follows the table. Having thus defined the species it will be possible to discuss their relationship to the adult forms.

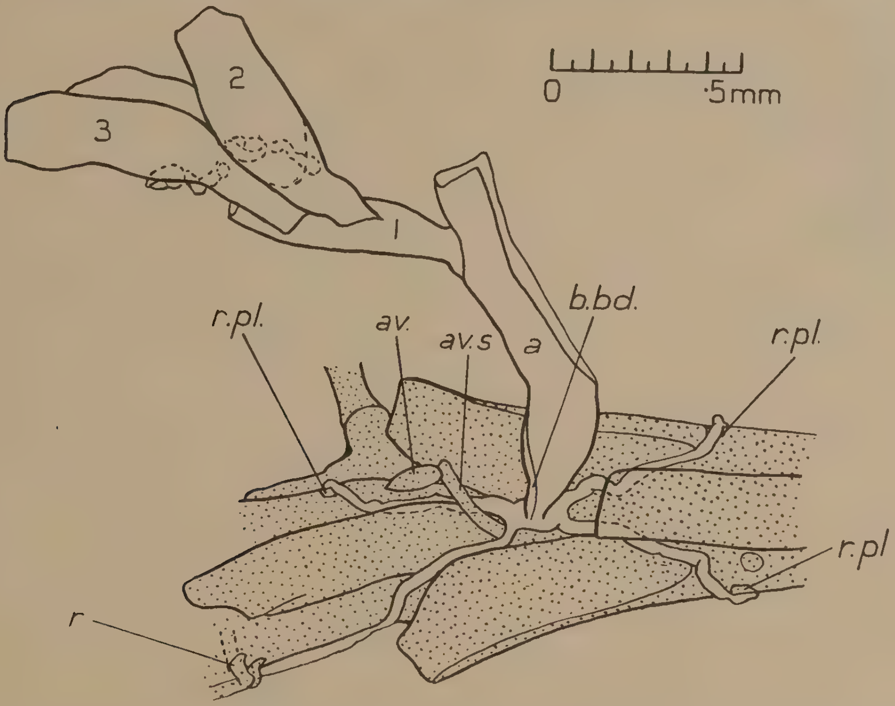

Fig. 40. *Camptoplites.* Young colony with ancestrula, species **2**, attached to type-material of *C. atlanticus.* St. WS 773, off Patagonian Shelf. Ancestrula is attached to the frontal surface of the supporting colony, which is stippled, and the roots can be seen passing round the stalk of an avicularium, and under the raised borders of the distal parts of the zooecia.

a. ancestrula, *av.* avicularium, *av.s.* avicularian stalk, *b.bd.* basal band, *r.* tips of two rootlets meeting root of ancestrula, *r.pl.* rosette-plate, 1–3, first three zooecia, seen in basal view, the avicularia and opesiae (dotted lines) seen through the zooecia by transparency.

Table 2. *Distribution of spines on young colonies of* Camptoplites, *species* 3 *to* 6

A, ancestrula. Z^1, Z^2, etc., zooecia in order of their formation. A single figure indicates an uninterrupted series of distal spines. Figures separated by a colon (3 : 1) indicate the number of outer and inner distal spines. Figures separated by a plus sign (9 + 1) indicate the number of distal and proximal spines. A bracket represents a bifurcation. A black terminal line indicates that the whole specimen or branch has been tabulated.

The bracket follows zooecium B (Harmer's lettering), and the numbering for each branch continues in the order of the formation of the zooecia starting with the inner (axillary) zooecium at the base of the branch.

To correspond with the numbering in the table the zooecia in Fig. 41 B marked 5, 6 and 4 should be 4, 4 and 5 respectively.

Station	*A*	Z^1	Z^2	Z^3	Z^4	Z^5	Z^6
Species 3							
WS 42 (F)	8+1	8	3 : 2	3 : 2	3 : 2	3 : 1	6
187	10+1	6	5	2 : 2	?	2 : 1	?▌
1652	6+1	7	7	6	6	{6 5	5 6
1652	8+1	7	6	5	6	5▌	
Gauss station as *multispinosa*	10+1	7	6	7	6	7	{6 7
Species 4							
181 (F)	9+1	4 : 2	3 : 1	2 : 1	{? 2 : 1	?▌	
181	7+1*	3 : 2	3 : 1	2 : 1	{2 : 1 ?	? ?	? ?
181	10	3 : 1	?	0▌			
Belgica as *spinosa*	6	3 : 2	2 : 1	2 : 1	2 : 1▌		
Species 5							
WS 42	4 : 3	3 : 1	3 : 1	3 : 1▌			
WS 42	4 : 4	2 : 1▌					
181 (F)	5 : 4	4 : 2	3 : 1	3 : 2	3 : 1	2 : 1	2 : 1
Species 6							
181	?	?	2 : 2	2 : 1	2 : 1	2 : 1	{2 : 1 2 : 1
181	2 : 2	2 : 2▌					
181 (F)	2 : 2	2 : 2	2 : 1	2 : 2	{0 ?▌	2 : 1	2 : 1
1660	1 : 1	2 : 1	?▌				
Nat. Ant. Exp. E. end Barrier	2 : 2	2 : 1▌					

* Spines on ancestrula represented by obscure stumps. F. Figured specimen.

Key to the ancestrulae of Camptoplites *in the collections*

1. Ancestrula with long stalk, with a swelling near its base, distal part of ancestrula flattened (i.e. distinctly broader from side to side than thick from frontal to basal surface) ... 2
   Ancestrula with moderate or short stalk without swelling, distal part not flattened... ... 3

2. Distal corners pointed, no spines, stalk forms little more than half of total length of ancestrula ... ... Species 1
   Distal corners bear spines and are drawn out giving appearance of a branched spine, a median distal spine on ancestrula and first zooecia, stalk forms more than two-thirds of total length of ancestrula ... ... Species 7

3. Spines absent ... ... Species **2**
Spines present 4

4. Ancestrula has a single series of distal spines and usually one proximal spine 5
Ancestrula has distal spines in two groups and no proximal spine 6

5. Separation of distal spines into two groups appears at first zooecium ... ... Species **4**
The first-formed zooecia have a single series of distal spines, separation into two groups appears later ... ... Species **3**

6. Opesia short, ancestrula with three to five spines at each corner ... ... Species **5**
Opesia long, ancestrula with one or two spines at each corner ... ... Species **6**

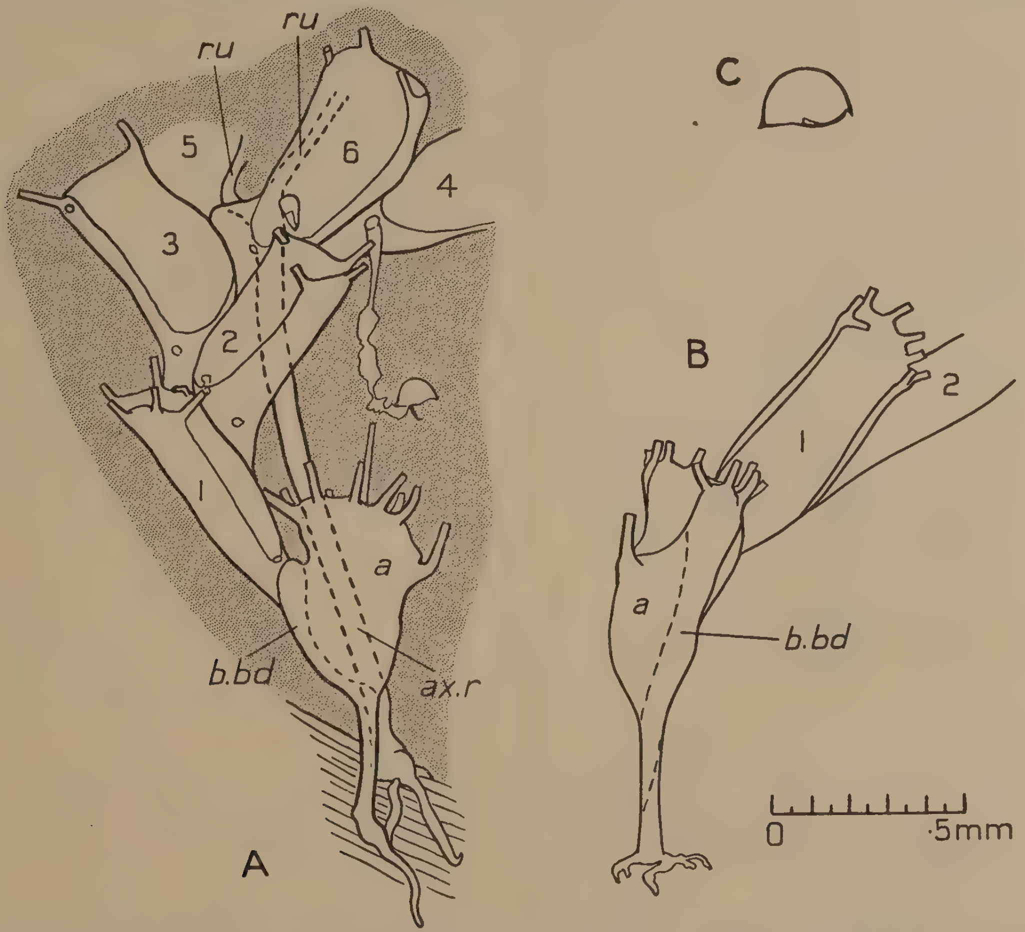

Fig. 41. A. *Camptoplites.* Ancestrula, species **4**. St. 181, Palmer Archipelago. The stalk of one of the avicularia is indistinguishable. B. *Camptoplites.* Ancestrula, species **3**. St. WS 42, South Georgia. The appearance of a ninth distal spine to the right of the ancestrula is erroneous. C. *Camptoplites.* Ancestrula, species **3**. St. 1652, Ross Sea. Avicularium.

a. ancestrula, *ax.r.* axillary rootlet, *b.bd.* basal band, *ru.* runner, 1–6, zooecia.

Relationship of ancestrulae to adult forms

Species **1** (Fig. 39 B). The general character of these four young colonies suggests the *C. bicornis* group, and the avicularia, which may be present on the first zooecium, resemble the large long-headed ones of var. *compacta*. Only a tentative identification is, however, possible.

Species 2 (Fig. 40). These specimens are evidently young colonies of the spineless species, *C. atlanticus*, with which they were found (see p. 460).

Species 3 (Fig. 41 B, C). These specimens closely resemble *C. multispinosus* (Kluge, 1914, p. 628, pl. xxx, fig. 2).

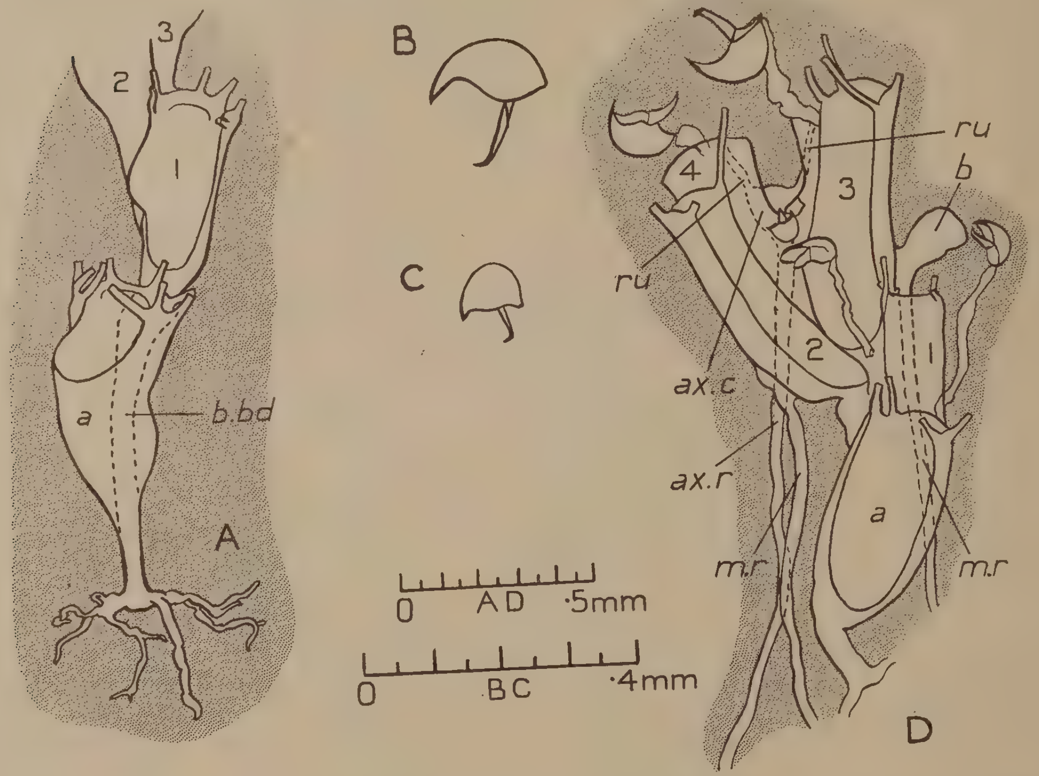

Fig. 42. A–C. *Camptoplites*. Ancestrula, species 5. St. 181, Palmer Archipelago. A. Ancestrula and first zooecia. B, C. Avicularia. D. *Camptoplites*. Ancestrula, species 6. St. 181, Palmer Archipelago. The small avicularium on zooecium 4 is foreshortened. The left-hand branch, drawn as if it ended, was continued, see Table 2, p. 438.

a. ancestrula, *ax.c.* axillary chamber, *ax.r.* axillary rootlet, *b.* bud, starting secondary branch, *b.bd.* basal band, *m.r.* marginal rootlet, *ru.* runner, 1–4, first four zooecia.

In spite of Kluge's opinion that colonies of this type represent a distinct species, I have no doubt that they are young colonies of some other form. They are all small colonies with few zooecia and the ancestrula intact, and the small size of the zooecia and more numerous spines are both characteristic features of the early stages of a colony. The colonies are not far enough advanced for recognition of the species.

The separation of the distal spines into two groups may be faintly indicated at the second or third zooecium, or not till after the second bifurcation, as in Kluge's figure, by which time a dozen zooecia with the distal spines in a single series may have been formed.

Species **4** (Fig. 41 A). Here also the colonies have not developed far enough for specific determination.

The young colony described by Waters as *Bugula reticulata* var. *spinosa* (1904, p. 22, pl. i, fig. 3 *a*, *b*) has a similar distribution of spines, and, like one of the specimens of species **4**, has no proximal spine on the ancestrula; but it has rootlets like those of species **6**. Kluge put Waters's form doubtfully in the synonymy of his *Bugula* sp. var. *variospinosa* (Kluge, 1914, p. 628, pl. xxviii, fig. 4) which I take to be a young colony of *Camptoplites areolatus* (see p. 465). Waters's figure differs from Kluge's in the zooecia which are more broad and square distally and diverge more from the axis of the colony; in the opesia which is longer, less definite, and without cryptocyst; and in the absence of any zooecia with more than one avicularium (see paired scars in Kluge's figure); differences which appear to me to be of specific value.

Species **5** (Fig. 42 A–C). The colony from St. 181 has developed far enough to show the characteristics of the zooecia and avicularia of *C. retiformis*.

Species **6** (Fig. 42 D). The avicularia show that this is *C. angustus*. The presence of what appears to be a secondary branch, of spines, and of axillary runners fits this conclusion.

The presence of lateral rootlets springing from the side of the zooecium, and not from the angle between two zooecia, suggests *C. tricornis*, but rootlets of this kind are apparently found in the young colonies of more than one species, as they are shown by Waters in a young colony which agrees better with species **4** than species **6**.

Species **7** (Fig. 39 A). There are two colonies with ancestrulae of this type. The one shown in the figure consists of the ancestrula and first few zooecia and has not developed far enough for identification. The other, from St. TN 194, is a large and characteristic specimen of *C. bicornis* var. *elatior*, and, although a little damaged, the ancestrula and first few zooecia agree so well with those of the other colony as to leave no doubt of the specific identity of the two.

Key to the species of Camptoplites

1. Secondary branches usually present,[1] ovicells tilted backwards and more or less shallow, their radial sculpture not changing markedly with age 2
Secondary branches absent, ovicells large, usually radially striated at first and with additional sculpture later[2] 7

2. Avicularia of various types including small long-headed avicularia with straight beak ... 3
Avicularia do not include the small long-headed type 5

3. Main branches biserial, rarely more series at bifurcation, secondary branches not fan-shaped (for key to varieties see p. 445) ... ... 1. **C. bicornis**
Some, at least, of the main branches with more than two series of zooecia, secondary branches fan-shaped (i.e. much branched) 4

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[1] Absent in the fragmentary specimens of typical *C. bicornis* and not reported in *C. abyssicolus*.

[2] No radial phase known in *C. reticulatus*. No additional sculpture known in *C. lunatus*, *C. asymmetricus* and *C. atlanticus*.

4. Round-headed avicularia with long down-turned beak, large long-headed avicularia sinuous dorsally (i.e. with concavity at beginning of beak) ... ... **7. C. giganteus**

Round-headed avicularia with small down-turned beak, large long-headed avicularia convex or straight dorsally[1] ... ... **6. C. lewaldi**

5. Avicularia all alike, branches biserial ... ... **9. C. abyssicolus**

Avicularia of two kinds, main branches with more than two series of zooecia 6

6. Three strong spines (of which one is median) on each non-fertile zooecium, large avicularia with pointed posterior process on each side, axillary secondary branches exceptional ... ... **8. C. tricornis**

Spines not median, avicularia without pointed processes, axillary secondary branches common ... ... **10. C. angustus**

7. Axillary rootlets adhering to basal surface of branch, outer distal corner of zooecium turning forwards ... ... **19. C. lunatus**

Axillary rootlets not adhering to basal surface, outer distal corner not turning forward (though spine may) 8

8. Cryptocyst present, zoarium biserial and jointed, lateral rootlet-chamber without runner ... 9

Cryptocyst absent, zoarium biserial or pluriserial, unjointed, lateral rootlet-chamber with runner 10

9. Axillary rootlet issues frontally and symmetrically, internal projection from basal wall of zooecium present, opesia usually short ... ... **20. C. areolatus**

Axillary rootlet issues basally and asymmetrically, no internal projection from basal wall, opesia usually long ... ... **21. C. asymmetricus**

10. Zoarium biserial, sometimes triserial in part, a single distal spine originating from basal surface of outer corner of some zooecia ... ... **18. C. reticulatus**

Zoarium pluriserial, spines, when present, on either or both of the distal corners, not basal 11

11. Zooecia very long, narrow, straight-sided, axillary rootlets issuing from frontal surface of chamber ... ... **17. C. rectilinearis**

Zooecia not very long, narrow or straight-sided, axillary rootlets issuing from basal surface of chamber 12

12. Spines present, avicularia of two kinds, large and small, ovicells radially striated at first, with additional sculpture later 13

Spines absent, avicularia all small, ovicells radially striated or fluted, without additional sculpture ... ... **16. C. atlanticus**

13. Spines directed frontally, zooecia not raised distally, large avicularia with long stalks, small avicularia very variable in size, their lower head-angle about 90° 14

Spines, with few exceptions, directed distally, zooecia somewhat raised distally, large avicularia short-stalked, small avicularia not very variable in size, their lower head-angle acute 15

14. Fully calcified ovicells rather heavily reticulate, some, at least, of the meshes more or less hexagonal, fertile zooecia with one or both spines long and stout ... **11. C. retiformis**

Fully calcified ovicells with light, irregular reticulation, not forming hexagonal meshes, spines on fertile zooecia not enlarged ... ... **12. C. retiformis var. tenuispina**

15. Fully calcified ovicell sparsely punctate, large avicularia not on marginal zooecia **13. C. latus**

Fully calcified ovicell not punctate, large avicularia usually on marginal zooecia 16

16. Fully calcified ovicell radially striated, not thickened or roughened, reticulation, if any, faint, spines directed distally, large avicularia round-backed ... **14. C. latus var. striata**

Fully calcified ovicell thickened and roughened after a distinct reticulate phase, spines variable directed distally or obliquely forward, large avicularia flat-backed. **15. C. latus var. aspera**

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[1] One specimen had a second type of large long-headed avicularium.

1. **Camptoplites bicornis** (Busk).

Bugula bicornis Busk, 1884, p. 40, pl. ix, fig. 1 *a–e*; Kluge, 1914, p. 622, text-fig. 7 *d–f*.
Camptoplites bicornis Harmer, 1923, p. 300.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. Southern Ocean, 53° 55′ S, 108° 35′ E, 3568 m. (Busk).

Secondary branches are not to be found in the type specimens of *Camptoplites bicornis* (87.12.9.196, 197; 99.7.1.271, 1013) which are fragmentary, and they are not shown by Busk. They might nevertheless be present in complete colonies. All three types of avicularia are present, as shown in the figures of Busk and Kluge (whose figures of the avicularia were drawn from one of Busk's preparations).

The varieties of Camptoplites bicornis

The Discovery collections include the three forms treated by Kluge as varieties of *C. bicornis*, and one, *C. bicornis* var. *quadriavicularis*, hitherto undescribed. The specimens of var. *magna* belong to forma *elongata*, forma *ventricosa* not being represented.

Kluge's varieties are clearly recognizable from his descriptions although there are discrepancies in the explanation of pl. xxix in which the main and secondary branches of var. *compacta* and var. *elatior* purport to be represented in four separate figures.

Fig. 1, described as a main branch of var. *compacta*, appears to represent two secondary branches with two zooecia of a main branch. It resembles the less compact specimens of var. *compacta* which is somewhat variable in the character from which it gets its name. Fig. 2 shows very compact secondary branches of the same variety.

Figs. 3 and 4, described as main and secondary branches respectively of var. *elatior*, both show main branches with small secondary branches. They clearly represent distinct varieties and, as they show all the main features of var. *magna* (which is not otherwise figured) and var. *elatior*, it seems likely that the plate was intended to show the main features of all three varieties and that a mistake was made in compiling the explanation. Unfortunately, the magnification of the figures is not given, so that a comparison of absolute dimensions cannot be made. The large long-headed avicularia in fig. 3 have a slightly more acute upper head-angle than any in Kluge's range for var. *magna* form *elongata* (115° as compared with 133–160°), but agree with the smallest avicularia found in my material of var. *magna*.

The little points on each side of the terminal point of the mandible of the round-headed avicularia (Fig. 43 N), which were figured by Kluge (fig. 9*c*, p. 623) in var. *elatior* and mentioned in his description of var. *magna* can be found in both varieties.

In addition to the differences noted by Kluge, the varieties appear to be distinguished by their ovicells. The ovicell of var. *compacta* was well figured by Kluge (text-fig. 7*c*). The proximal expansion shown in the figure is the base of the distal zooecium. Waters (pl. i, fig. 4*a*) also shows this ovicell quite well. It occupies less than two-thirds of the width of the zooecium, the distal corners of which rise to a point on either side of it (Fig. 44 C). At each side, where it joins the ovicell, the distal wall is thickened and prominent, and this calcareous thickening is sometimes continued down the sides of the ovicell.

In var. *elatior* the ovicell is flanked by the pointed corners of the zooecium as in var. *compacta*, but is wider in proportion to the width of the zooecium and there is no marked thickening of the shoulders (Fig. 44 D).

In var. *magna* the ovicell occupies nearly the whole width of the zooecium, the distal corners being small and inconspicuous, the lateral walls of the ovicell converge at an obtuse angle and there is no thickening of the shoulder (Figs. 44 E, 45 A, B).

In var. *quadriavicularis* the ovicell is as wide as the distal end of the zooecium (Fig. 44 A, B).

In all four varieties the rosette-plates connecting the ovicell with the distal zooecium are very variable, and the ovicell may be symmetrical or asymmetrical according to the position in which the distal zooecium arises from the fertile zooecium.

The type material of *C. bicornis* agrees with Kluge's varieties in the absence of the thickening at the base of the avicularian beak. This thickening is present in some of the long-headed avicularia of *C. bicornis* var. *quadriavicularis*.

The correlated differences in the general build of the colony (cf. pl. X, figs. 1–3), the form of the zooecia (pl. XI, figs. 1–3 and Kluge's figures), the avicularia and the ovicells are such that these forms might well be given specific rank, but, until more is known of typical *C. bicornis*, I have preferred to leave untouched Kluge's classification of them as varieties of that species.

Both Kluge (1914, p. 621) and Waters (1904, p. 21) refer to cross-connexions between the branches in *C. bicornis*. In my material these connexions are found in the older parts of the colonies, and may be numerous, but, except in one specimen of var. *quadriavicularis*, they are very irregular in arrangement and the tips of the branches are free.

Livingstone's material (1928, p. 27) was not in good enough condition for him to determine its relation to Kluge's varieties, and has therefore had to be omitted from my statements of distribution.

Calvet (1909, p. 8) evidently included at least two species in *C. bicornis*, as noticed by Kluge (1914, p. 621). Both had secondary branches and the three types of avicularia found in *C. bicornis* and several other members of the *bicornis* group. The specimen from Booth-Wandel Island had biserial branches which became tri- or quadriserial at the bifurcations. As the only known members of the *bicornis* group showing this character are *C. bicornis* var. *quadriavicularis*, which has four kinds of avicularia, and *C. giganteus*, Calvet's specimen may have belonged to *C. giganteus*. The specimens from Schollaert Bay had three to ten series of zooecia. This clearly distinguishes them from any of the varieties of *C. bicornis* and points to *C. lewaldi* as the only known form with which they agree. A process of elimination thus suggests that Calvet had *C. giganteus* and *C. lewaldi*, but there is not positive evidence to prove either suggestion.

Ancestrulae believed to belong to two of the varieties of *C. bicornis* are described above (pp. 438, 439), as species **2** and species **7**.

Key to the varieties of Camptoplites bicornis *in the present collections*

1. Small long-headed avicularia with thickening where beak joins head (as in *Bugula*), round-headed avicularia usually of two sizes ... ... 5. **var. quadriavicularis**
   Avicularia without thickening where beak joins head, round-headed avicularia all of one size 2
2. Ovicell occupying less than two-thirds of width of zooecium, large long-headed avicularia relatively small, fairly uniform in size, their upper head-angle less than 100° ... ... 2. **var. compacta**
   Ovicell occupying more than two-thirds of width of zooecium, large long-headed avicularia variable in size mostly relatively large, their upper head-angle at least 115°, usually more 3
3. Zooecia tapering proximally fairly gradually, zooecia of main branches considerably longer than those of secondary branches, distal corners not conspicuously pointed ... ... 3. **var. magna**
   Zooecia narrowing rather suddenly at beginning of tubular part, zooecia of main branches not markedly different from those of secondary branches, distal corners drawn out into almost spine-like points ... ... 4. **var. elatior**

2. **Camptoplites bicornis** var. compacta (Kluge). Plates X, fig. 1, XI, fig. 1; Figs. 43 M, 44 C.

Bugula bicornis var. *compacta* Kluge, 1914, p. 619, pl. xxix, figs. 1, 2, text-figs. 7 *a–c*, 8 (not text-fig. 7 *d–f*, see *C. bicornis*).

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, St. 187; Victoria Quadrant, Sts. 1652, 1660.

GEOGRAPHICAL DISTRIBUTION. Palmer Archipelago (Discovery); Bellingshausen Sea; Wilhelm II Land (Kluge); Ross Sea (National Antarctic Expedition; Terra Nova; Discovery).

The varieties of *Camptoplites bicornis* are compared on p. 443.

The upper head-angle of the large long-headed avicularia of my material may be as much as 100° though it is usually nearer 80°.

Kluge (p. 622) explains that the avicularia in his text-fig. 7 were drawn from the type specimen of *C. bicornis* and not from var. *compacta*.

3. **Camptoplites bicornis** var. magna (Kluge). Plates X, fig. 2, XI, fig. 2; Figs. 44 E, 45 A, B.

Bugula bicornis var. *magna* form *elongata* Kluge, 1914, p. 623, text-fig. 10.

Bugula bicornis var. *elatior* (part) Kluge, 1914, pl. xxix, fig. 3.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, Sts. 39, 164, 180, 187 and Deception Island; Victoria Quadrant, Sts. 1652, 1660.

GEOGRAPHICAL DISTRIBUTION. South Georgia; South Orkney Islands; South Shetland Islands; Palmer Archipelago (Discovery); Bellingshausen Sea; Wilhelm II Land (Kluge); Ross Sea (Terra Nova; Discovery).

The varieties of *Camptoplites bicornis* are compared on p. 443.

The large long-headed avicularia of my material of var. *magna* are all of the type of Kluge's form *elongata*. They correspond in size and general shape to the smaller avicularia of the series figured by Kluge, but the smallest are even smaller. These smallest ones approach those of var. *compacta* in size but have a more obtuse upper head-angle (115°).

As a result of the absence of the larger sizes of large long-headed avicularia in my material of var. *magna* there is no noticeable difference from var. *elatior* in range of size, but the upper head-angle is usually more obtuse in the latter form. Waters's specimen, attributed to var. *magna* by Kluge, was also without large long-headed avicularia of maximum size.

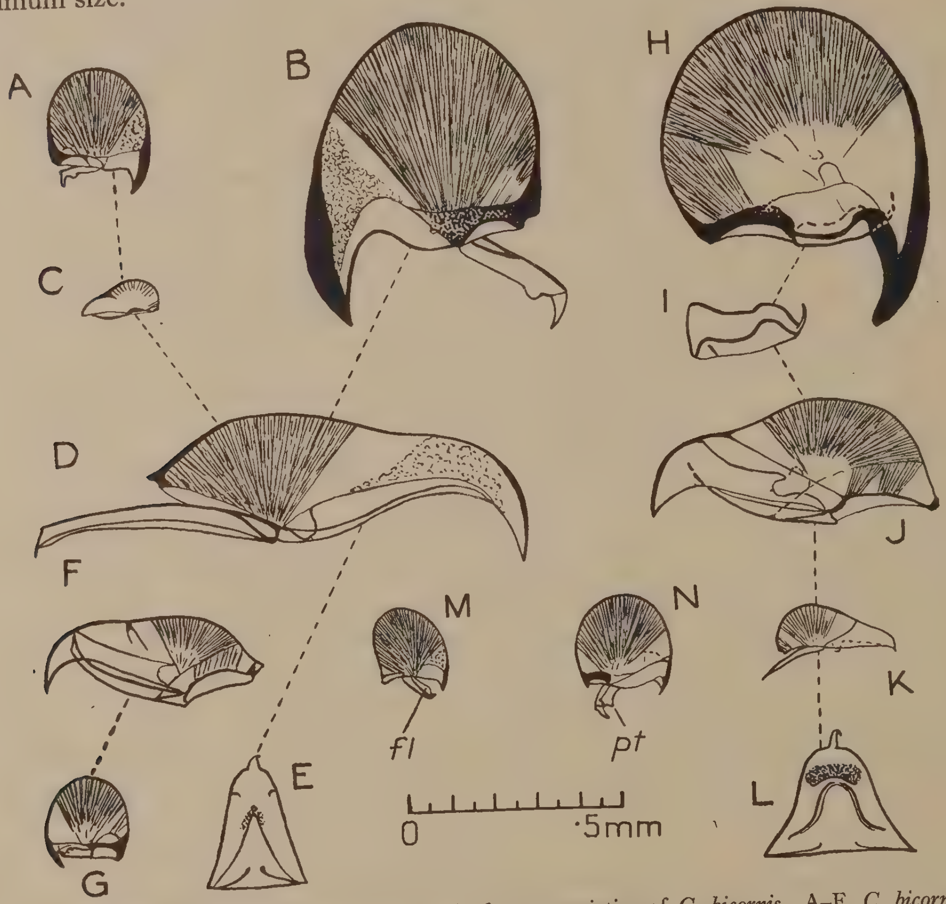

Fig. 43. Avicularia of *Camptoplites giganteus* and of some varieties of *C. bicornis*. A–E. *C. bicornis* var. *quadriavicularis* var.n. From the type-specimen, St. 160, Shag Rocks. A. Small round-headed. B. Large round-headed. C. Small long-headed. D. Large long-headed. E. Mandible of large round-headed avicularium. F, G. *C. bicornis* var. *quadriavicularis* var.n. From the specimen from St. WS 871, off Patagonian Shelf. Small long-headed not figured. F. Large long-headed. G. Round-headed. H–L. *C. giganteus* (Kluge). St. WS 33, South Georgia. H. Round-headed. I. Mandible of round-headed, oblique lateral view. J. Large long-headed. K. Small long-headed. L. Mandible of round-headed avicularium. M. *C. bicornis* var. *compacta* (Kluge). St. TN 339, Ross Sea. Round-headed avicularium. N. *C. bicornis* var. *elatior* (Kluge). St. 180, Palmer Archipelago. Round-headed avicularium.

fl. flange, *pt*. point.

A small specimen from St. 39 (South Georgia) has no round-headed avicularia, but is otherwise typical, and in the large colony from St. 180 (Palmer Archipelago) the avicularia are all of the small long-headed type.

4. **Camptoplites bicornis var. elatior** (Kluge). Plate XI, fig. 3; Figs. 43 N, 44 D.

Bugula bicornis var. *elatior* Kluge, 1914, p. 622, pl. xxix, fig. 4, text-fig. 9 (not pl. xxix, fig. 3).

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, Sts. 180, 190, 1948.

GEOGRAPHICAL DISTRIBUTION. Near Elephant Island; Palmer Archipelago (Discovery); Bellingshausen Sea; Wilhelm II Land (Kluge); off Oates Land (Terra Nova).

The varieties of *Camptoplites bicornis* are compared on p. 443.

The Discovery material from St. 180 agrees very closely with var. *elatior* as represented in Kluge's diagnosis and pl. xxix, fig. 4. In the specimens from Sts. 190 and 1948 the upper head-angle of the large long-headed avicularium is more obtuse and may measure as much as 150°.

The ancestrula is described on p. 438 (species 7).

5. **Camptoplites bicornis var. quadriavicularis var.n.** Plates X, fig. 3, XII, figs. 1, 2; Figs. 43 A–G, 44 A, B.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, St. WS 871. *Antarctic:* Weddell Quadrant, St. 160.

GEOGRAPHICAL DISTRIBUTION. Off Patagonian Shelf, below 300 m. (Discovery; 34.11.12.10, 85)[1]; Shag Rocks (Discovery).

HOLOTYPE. St. 160, Shag Rocks.

DESCRIPTION. *Main branches* biserial, except at bifurcation where there may be three, or rarely four, series in younger parts of colony, zooecia moderately elongated, tapering fairly uniformly towards proximal end (Fig. 44 A), distal end of zooecium raised, distal corners angular, the inner one sometimes spike-like or bearing a spine.

Secondary branches biserial, zooecia shorter than those in main branches and tapering more rapidly, distal corners as in main-branch zooecia.

Runners only present where axillary chamber forms rootlet.

Ovicell (Fig. 44 B) very shallow and as wide as the zooecium, see pp. 443–444.

Avicularia exceptionally long-stalked. Round-headed avicularia all of the same shape, but usually of two sizes, larger ones gigantic; beak long, stout, down-turned; mandible with knob on each side of distal point (Fig. 43 A, B). Large long-headed avicularia big, with strongly curved beak (Fig. 43 D), upper head-angle 125–135°, stalks often of very great length (may be more than four times as long as a typical main-branch zooecium). Small long-headed avicularia as in other varieties of *Camptoplites bicornis* except for presence of oblique calcareous thickening separating beak from head (Fig. 43 C), attached to gymnocyst near proximal border of opesia, leaving small scar when detached. Other three kinds attached more proximally leaving large scars (Fig. 44 A).

REMARKS. The type colony is a bushy tuft 2 in. high (Plate X, fig. 3). In its main characters this form agrees with *C. bicornis*, as understood by Kluge, and is nearest to var. *magna* from which it differs in the shape of the zooecia, particularly those of the secondary branches, in the presence of the thickening in the head of the small long-headed avicularia, in the great length of the avicularian stalks, and in the presence in most specimens of gigantic round-headed avicularia as well as the smaller ones.

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[1] Found among material of other species from Challenger St. 320.

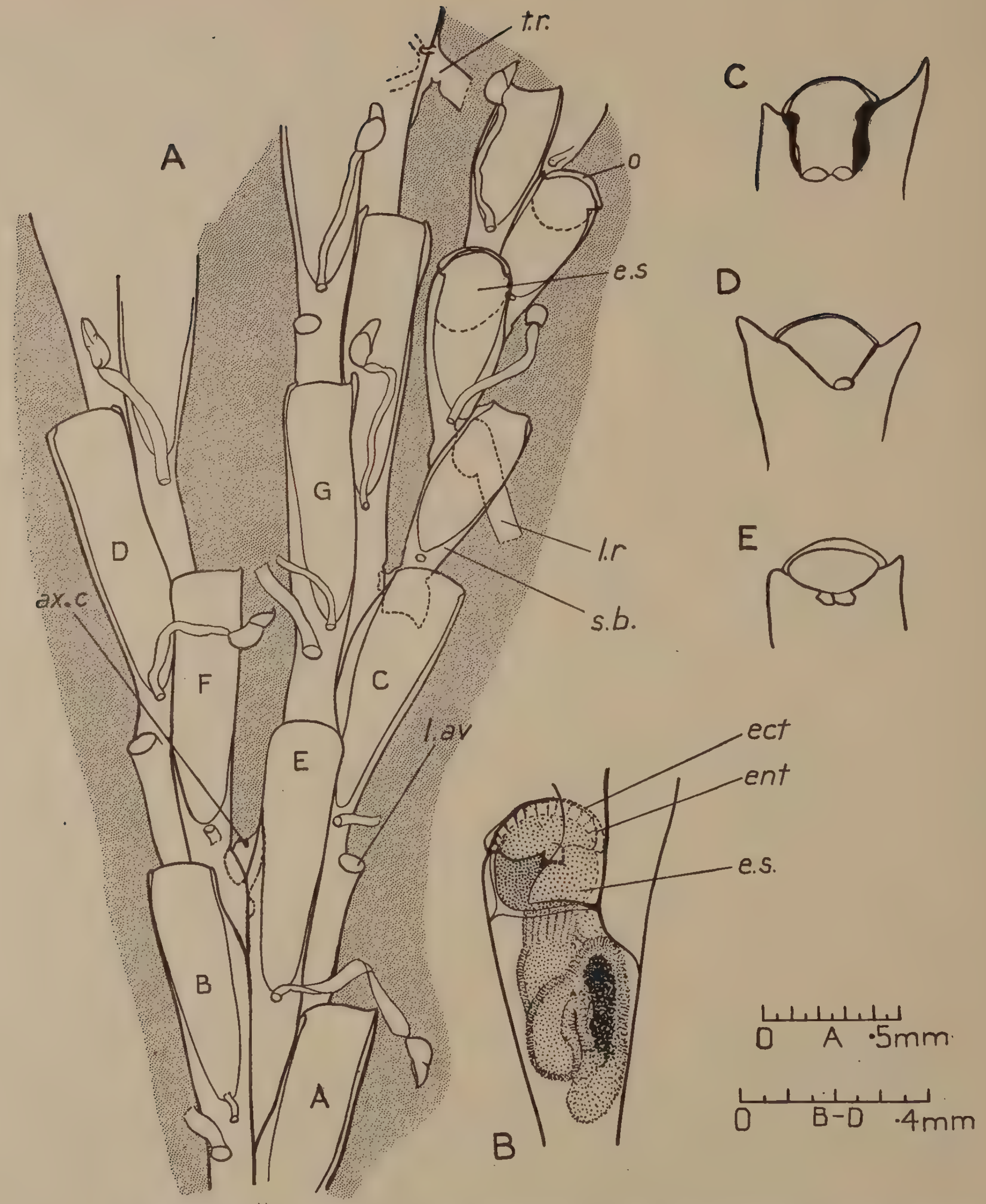

Fig. 44. A; B. *Camptoplites bicornis* var. *quadriavicularis* var.n. St. 160, Shag Rocks. A. Part of the type, with bifurcation lettered according to Harmer's scheme. Several avicularia are represented by scars or broken stalks. B. Fertile zooecium in basal view, showing a complete polypide in the zooecium and an advanced embryo in the embryo-sac. The zooecium preceded a bifurcation and gave rise to two distal zooecia. C. *C. bicornis* var. *compacta* (Kluge). St. 1660, Ross Sea. Distal part of a fertile zooecium in frontal view with soft parts omitted. D. *C. bicornis* var. *elatior* (Kluge). St. 190, Palmer Archipelago. Distal part of fertile zooecium as in Fig. C. E. *C. bicornis* var. *magna* (Kluge). St. 1652, Ross Sea. Distal part of fertile zooecium as in Figs. C and D.

ax.c. axillary chamber, *ect.* ectooecium, *ent.* entooecium, *e.s.* embryo sac, *l.av.* scar of large avicularium, *l.r.* lateral rootlet, *o*, ovicell, *s.b.* secondary branch, *t.r.* tip of rootlet from neighbouring branch.

Bifurcations of Harmer's type 4 are sometimes found in the main branches which may thus have as many as four series of zooecia immediately before the bifurcation. The large round-headed avicularia resemble those of *C. giganteus* in their long stout beak, but differ in the thicker spike on the tip of the mandible (cf. Fig. 43 B and I), the relatively straight sclerites (cf. Fig. 43 E and L), and the flatter back of the head of the avicularium as seen in profile (cf. Fig. 43 B and H). The large long-headed avicularia have a more obtuse upper head-angle than those of *C. giganteus* (cf. Fig. 43 D and J). Lateral oval areas as described on p. 339 are to be seen on some zooecia.

The specimen from St. WS 871 (off the Patagonian Shelf) is rather different from the type (cf. Plate XII, figs. 1 and 2). Cross-connexions by rootlets are more common, the branching is more profuse and the zooecia shorter, so that the colony is reticulate and resembles the colonies of the *reticulatus* group, rather than those of typical var. *quadriavicularis*. There are no large round-headed avicularia and the small round-headed avicularia are smaller. The large long-headed avicularia are much shorter and have a thickening where the beak joins the head. In the type a faint trace of such thickening is occasionally visible, but the majority of these avicularia show none at all. A spine is present on the inner distal corner of some zooecia of the Patagonian specimen, whereas the corners in the type may be spike-shaped but are not drawn out into true spines. Despite these differences it is unlikely that the specimen from St. WS 871 represents a distinct variety. Fragmentary material from Challenger St. 320 (which is also off the Patagonian Shelf) is intermediate in character. The branches have the straggling appearance of those of the typical colony, there are few cross-connexions, and both large and small round-headed avicularia are present. On the other hand, the large long-headed avicularia, which are of intermediate size, have a thickening where the beak joins the head, and spines are present on some zooecia.

In the type-specimen, which was taken on 7 February 1927, ovicells are very numerous on both main and secondary branches. Some of these fertile zooecia have the ovicell empty and a large egg in a follicle in the body cavity. A very delicate ovisac can sometimes be detected, the shallow ovicell forming a cap to it. In other zooecia the egg is in various stages of segmentation and occupies the ovisac. In many of the fertile zooecia the polypide is wholly or partially degenerate, but some in which the embryo is at an advanced stage have a complete and normal polypide (Fig. 44 B).

6. **Camptoplites lewaldi** (Kluge). Plate XI, figs. 5, 6; Fig. 45 C, D, G.

Bugula lewaldi Kluge, 1914, p. 630, pl. xxx, fig. 3, text-fig. 15.

Camptoplites lewaldi Harmer, 1923, p. 300.

STATION DISTRIBUTION. *Antarctic:* Victoria Quadrant, Sts. 1652, 1660.

GEOGRAPHICAL DISTRIBUTION. Wilhelm II Land (Kluge); Ross Sea (National Antarctic Expedition; Discovery).

Secondary branches are present in these specimens, but apparently develop rather late. The Discovery material from St. 1652 comprises some pieces with well-developed fan-shaped secondary branches placed at regular intervals throughout their length

(Plate XI, fig. 6), and others which, although the specimens are more than 2 cm. long, branched, and with as many as six series of zooecia, have few secondary branches, and these only on the proximal parts, and consisting of few zooecia, often of only one (Plate XI, fig. 5). It is thus not surprising that no secondary branches were present in Kluge's material, and the very close agreement with his description in other ways puts the identification beyond doubt.

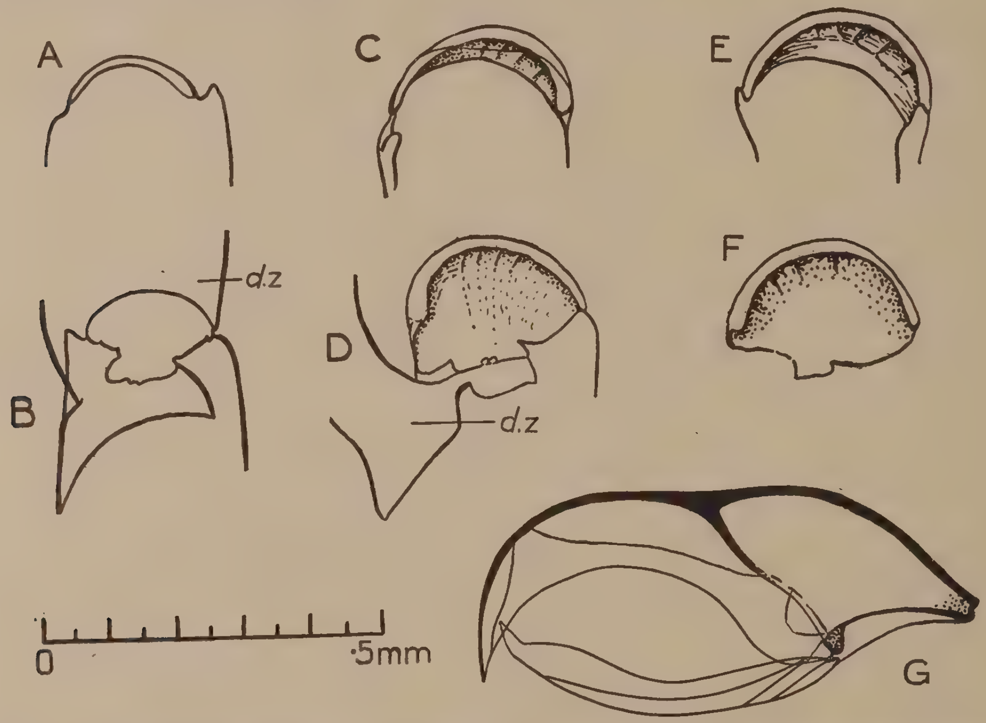

Fig. 45. A, B. *Camptoplites bicornis* var. *magna* (Kluge). St. 1652, Ross Sea. Frontal and basal views of an ovicell on a main branch. C, D. *C. lewaldi* (Kluge). St. 1652, Ross Sea. Frontal and basal views of an ovicell on a secondary branch. In Fig. D note the process connecting the ovicell and the distal zooecium. E, F. *C. giganteus* (Kluge). St. WS 33, South Georgia. Frontal and basal views of an ovicell on a secondary branch. G. *C. lewaldi* (Kluge). St. 1652, Ross Sea. Large avicularium.
d.z. distal zooecium.

The axillary chamber forms runners. Ovicells, which were absent in Kluge's material, are present in mine (Fig. 45 C, D). They are of the same general pattern as those of the other species of the *bicornis* group, and are rather markedly reduced (see p. 436). Where the distal zooecium is at an angle to the fertile zooecium, a process from its proximal end connects it with the ovicell (Fig. 45 D). Elsewhere in the same colony the two zooecia are more in line and the proximal end of the distal zooecium lies basally to the ovicell and is connected with it in the usual way.

A specimen of *Camptoplites lewaldi* from St. 1652 has one exceptionally large long-headed avicularium (Fig. 45 G). In it the upper head-angle is more obtuse and the lower more acute than in those of ordinary size. The beak forms a greater proportion of the total length. The specimen had avicularia of all the usual three kinds as well as this large one.

7. **Camptoplites giganteus** (Kluge). Plate XI, fig. 4; Figs. 43 H–L, 45 E, F.

Bugula gigantea Kluge, 1914, p. 630, pl. xxx, fig. 4, text-fig. 16.

Camptoplites giganteus Harmer, 1923, p. 300.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, St. WS 33.

GEOGRAPHICAL DISTRIBUTION. South Georgia (Discovery; Shackleton-Rowett Expedition); Wilhelm II Land (Kluge); Ross Sea (Terra Nova).

These specimens agree in most respects with Kluge's description. The two kinds of long-headed avicularia are similar (Fig. 43 J, K), the round-headed avicularia (Fig. 43 H) have the long down-turned beak ("ziemlich langem, senkrecht zur Obermandibel an ihrem freien Ende stehenden, spitzen Auswuchs"), the zooecia of the main branches are as shown in Kluge's figure and the ovicells agree with his description.

The specimens from South Georgia differ from Kluge's in the possession of secondary branches (Plate XI, fig. 4). These when fully formed are much branched, spreading out fanwise. The material from Ross Sea consists of small fragments only and does not show secondary branches. In all my material the axillary chamber forms runners.

The round-headed avicularia from both localities vary a little in size, but form a graded series rather than two groups as in *Camptoplites bicornis* var. *quadriavicularis*. They are all larger than those of *C. lewaldi* (cf. Plate XI, figs. 4, 5 and 6). Kluge does not mention this and it seems possible that his specimens had smaller avicularia.

This species is closely allied to *C. bicornis*. Its ovicells (Fig. 45 E, F) are rather less reduced, being intermediate between those of *C. lewaldi* and *C. tricornis*.

8. **Camptoplites tricornis** (Waters). Plate XIII, fig. 3; Fig. 46 B, C.

Bugula tricornis Waters, 1904, p. 23, pl. i, fig. 9 *a–d*, pl. viii, fig. 3; Livingstone, 1928, p. 27 (references).

Camptoplites tricornis Harmer, 1923, p. 300.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, Sts. 27, 42, 156, 160, WS 27, WS 33, WS 42, MS 68; Victoria Quadrant, Sts. 1651, 1652, 1660.

GEOGRAPHICAL DISTRIBUTION. South Georgia; Shag Rocks (Discovery); Bellingshausen Sea (Waters); Adelie Land (Livingstone); Wilhelm II Land (Kluge); Oates Land (Terra Nova); Ross Sea (National Antarctic Expedition; Terra Nova; Discovery; 30.3.5.1–4).

After examination of the Belgica collection Kluge (1914, p. 625) described this strongly characterized species under the name introduced by Waters. Waters's figures are not characteristic, and in particular do not show the median spine, but two peculiarities of the species are recognizable, namely, the lateral proximal points on the large avicularia, and the unusual position of the lateral rootlet-chamber (Fig. 46 C). These chambers, from which the lateral rootlets and the secondary branches both originate, are not in the angle between two successive marginal zooecia, as in other species, but are on the side of one zooecium where it bends upwards, as figured by Waters and described by Kluge. Both the axillary and the lateral chambers (Fig.

46 B, C) are without runners. The rootlets may terminate in a branched disk. The smaller avicularia have blunt mandibles.

The colonies vary in general appearance. Some are profusely branched, with many secondary branches and rootlets, and present a dense mat-like appearance (Plate IX, fig. 3). Others, such as the colony from St. 1651, are more lax in growth. The material from St. 1660 includes some specimens with long straight zooecia forming broad strap-like branches with as many as twelve series of zooecia. Other specimens from the same station have shorter, less straight, zooecia, and narrower branches. There is also variation in the spines which are sometimes very stout, the median distal one being particularly large. This is well seen, for example, in the material from St. TN 194.

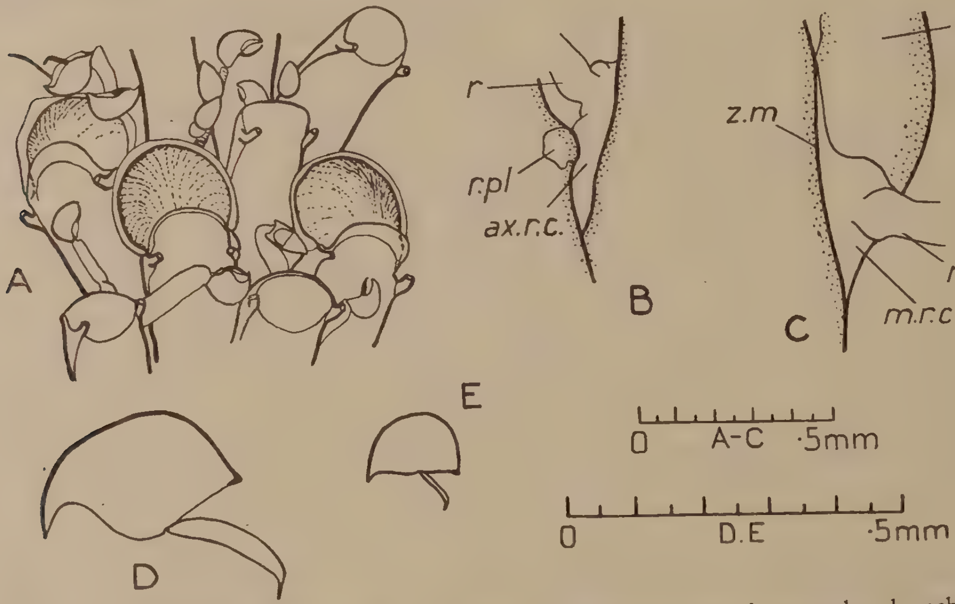

Fig. 46. A. *Camptoplites angustus* (Kluge). St. TN 340, Ross Sea. Part of a secondary branch. Three zooecia have their opercula open. B, C. *C. tricornis* (Waters). 30·3·5·4. Ross Sea. B. Axillary rootlet-chamber. C. Marginal rootlet-chamber, with rootlet and base of secondary branch. D, E. *C. angustus* (Kluge). St. TN 339, Ross Sea. Avicularia.

ax.r.c. axillary rootlet-chamber, *m.r.c.* marginal rootlet-chamber, *r.* rootlet, *r.pl.* rosette-plate, *z.m.* wall of marginal zooecium of main branch, *z.s.* zooecium of secondary branch.

9. Camptoplites abyssicolus (Kluge).

Bugula abyssicola Kluge, 1914, p. 632, text-fig. 18.

Camptoplites abyssicolus Harmer, 1923, p. 300.

Station distribution. Not represented in the Discovery collections.

Geographical distribution. Southern Ocean, 2450 m. (Kluge).

I have seen no specimen of this species.

10. Camptoplites angustus (Kluge). Plate XII, fig. 3; Fig. 46 A, D, E.

Bugula angusta Kluge, 1914, p. 631, pl. xxx, fig. 5, text-fig. 17.

Camptoplites angustus Harmer 1923, p. 300.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, Sts. 167, 181[1] and Deception Island; Victoria Quadrant, Sts. 1652, 1660.

GEOGRAPHICAL DISTRIBUTION. South Orkney Islands; South Shetland Islands (Discovery); Palmer Archipelago[1] (Discovery); Bellingshausen Sea? (Waters); Wilhelm II Land (Kluge); Oates Land (Terra Nova); Ross Sea (National Antarctic Expedition; Terra Nova; Discovery).

The shape of the colony, with straight main branches, consisting of several series of zooecia, and giving off fan-shaped secondary branches at fairly regular intervals on each side, is characteristic (Plate XII, fig. 3). There is commonly a secondary branch at the bifurcation, arising from the axillary chamber. Ovicells (Fig. 46 A) are numerous on the secondary branches. They are like those of *Camptoplites abyssicolus* (Kluge, 1914, text-fig. 18, p. 632), but are less reduced.

The avicularia are very variable in size so that they do not obviously represent two kinds, but two types, distinguished on p. 435, are nevertheless present (Fig. 46 D, E). My specimens agree so well with Kluge's account in other respects that I have no hesitation in making the identification, despite his statement that the avicularia are all of one form though varying in size.

Ancestrulae which appear to belong to this species are described on p. 438 (species **6**).

11. **Camptoplites retiformis** (Kluge). Plate IX, fig. 3; Figs. 47 A–H, 48 A, B.

Bugula retiformis Kluge, 1914, p. 629, pl. xxviii, fig. 5, text-fig. 14; Livingstone, 1928, p. 27.

Camptoplites retiformis Harmer, 1923, p. 300.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, Sts. 27, 39, 42, 156, 181, 187, 190, 1948, WS 33, WS 42, MS 71; Victoria Quadrant, Sts. 1652, 1660.

GEOGRAPHICAL DISTRIBUTION. South Georgia; near Elephant Island; Palmer Archipelago (Discovery); Wilhelm II Land (Kluge); Queen Mary Land (Livingstone); Oates Land (Terra Nova); Ross Sea (Terra Nova; Discovery).

The appearance of the ovicells differs markedly with age. When first formed the entooecium is radially striated, but a reticulate sculpture is gradually laid down, eventually becoming very conspicuous. This is particularly well seen in a large colony from St. WS 42 (South Georgia) which has two fertile zones (Plate IX, fig. 3). In the younger zone there is a gradation from incompletely formed ovicells through complete ones with radial striation to those in which the reticulation has begun to appear, but is faint and delicate (Fig. 48 A). In the second zone the full sculpture is present (Fig. 48 B). The fertile zooecia of both zones bear the long, stout spines on one or both distal corners. The spines on the non-fertile zooecia are also directed frontally, but are short and slender.

Rosette-plates are present in the outer lateral walls of the zooecia in the marginal series, and the tips of the runners and of the lateral rootlets tend to be in contact with them. In Fig. 47 H the tips of both runners of the axillary chamber and of three of the four branches of the lateral rootlet end in this way. The connexion is so frequent that it seems unlikely that it is accidental. Sometimes, too, the ends of rootlets that have not run directly to a rosette-plate have turned and grown along the edge of the colony till

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[1] Only represented by the young colonies described on p. 438, species 5, no adult colony taken.

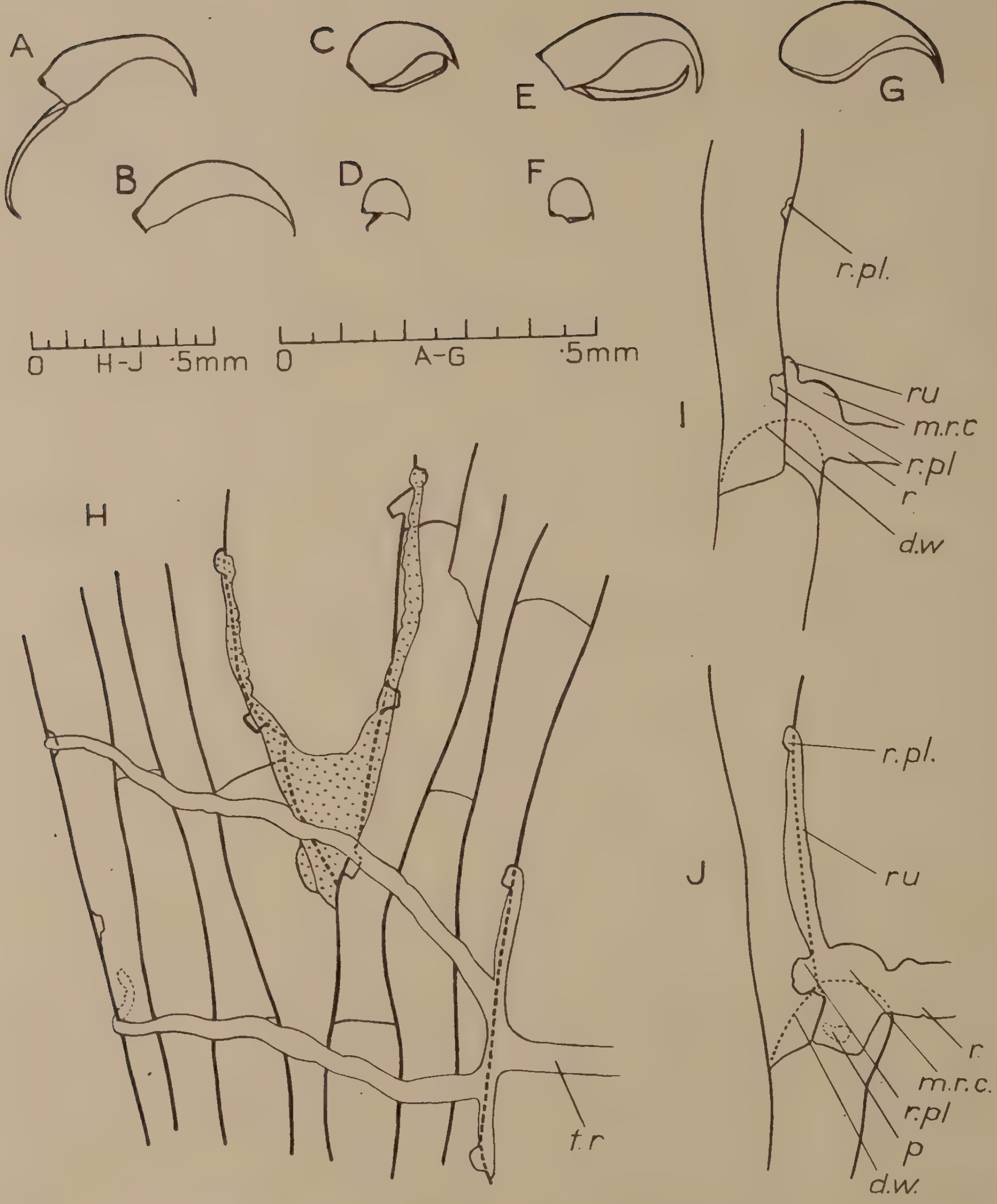

Fig. 47. A–G. Avicularia of *Camptoplites retiformis* (Kluge). A, B. St. WS 42, South Georgia. Mandible omitted in Fig. B. C, D. St. 187, Palmer Archipelago. E, F. St. 156, South Georgia. G. St. TN 339, Ross Sea. Mandible omitted. H. *C. retiformis* (Kluge). St. 156, South Georgia. Basal view of a bifurcation and the tip of a rootlet from the next branch. I, J. *C. latus* var. *aspera* var.n. St. 45, South Georgia. Lateral rootlet-chamber and parts of adjacent zooecia, basal view. I. Early stage near tip of branch. J. From more proximal part of the same branch showing more developed runner.

d.w. distal wall of zooecium, *m.r.c.* marginal rootlet-chamber, *p.* pore connecting rootlet-chamber and zooecium, *r.* rootlet, *r.pl.* rosette-plate, *ru.* runner, *t.r.* tip of rootlet from next branch. Axillary chamber and runners stippled.

they have come to one, or (as in the fourth branch in the figure) have grown rather deviously towards one. It is difficult to see whether there is any continuity of living substance through the rosette-plate, but where the tissues are abundant their arrangement suggests that there is. Similar connexions of rootlets and runners with rosette-plates have been seen in *Camptoplites latus* (Fig. 47 I, J), *C. reticulatus*, *C. asymmetricus*, *C. atlanticus*, and *C. rectilinearis*. In *C. atlanticus* the attaching rootlets of young colonies are connected with the rosette plates of the supporting colony in the same way (Fig. 40).

The small avicularia are short in proportion to their height, with the front and back of the head almost parallel, and the lower head-angle about 90° (Fig. 47 D, F). They vary in size within the colony, some being very small indeed.

The large avicularia vary in size and shape (Fig. 47 A–G) within the species as understood here, those from South Georgia (Fig. 47 A, B, E) being more slender and usually, but not always (Fig. 47 B), flatter dorsally than those from the Palmer Archipelago and Ross Sea. It is perhaps worth noticing that the large avicularia of *C. asymmetricus* (Fig. 55 C, E), particularly of the South Georgian specimen (Fig. 55 E) are more slender and less curved than those of *C. areolatus*, the related species from further south (Fig. 55 A), and that the large avicularia of the South Georgian *C. latus* var. *aspera* differ similarly from those of typical *C. latus* and *C. latus* var. *striata* which are found in more southerly Antarctic localities (cf. Kluge, 1914, text-fig. 20, and my Fig. 49 E, F). In a specimen of *C. retiformis* from St. 190 (Palmer Archipelago) the large avicularia are unusually large and numerous. This specimen has no ovicells.

In the specimens from the Ross Sea region and the Palmer Archipelago the ovicells are usually rather narrow in proportion to their height, and the meshes of their reticulate sculpture are large and regular (Fig. 48 B). In the specimens from South Georgia they are more variable, some tending to be broader with less regular reticulation, though others are more typical. In these ways the South Georgian ovicells approach those of var. *tenuispina* (Fig. 48 C), but they always show the rather regular reticulation of the typical form over part of their surface; the sculpture, when complete, is thick, as in the typical form; and there are stout spines on the fertile zooecia.

Among the specimens from St. 1660 (Ross Sea) there are some with broad branches composed of as many as fifteen series of zooecia.

The ancestrula of *C. retiformis* is described above, p. 438 (species 5).

Calvet's figure of his supposed *C. reticulatus* (1909, pl. i, fig. 3) might well represent *C. retiformis*, but as he attributes it without comment to a biserial species, it is to be presumed that his specimens were biserial. They may have belonged to *C. areolatus* (see p. 465).

12. **Camptoplites retiformis var. tenuispina var.n.** Fig. 48 C, D, E.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, Sts. 195, 363, 371.

GEOGRAPHICAL DISTRIBUTION. South Sandwich Islands; South Shetland Islands (Discovery).

HOLOTYPE. St. 195, South Shetland Islands.

The specimens from the South Shetland and South Sandwich Islands appear to represent a distinct variety, differing from the typical form in the ovicells and in the absence of any distinction between the spines of the fertile and non-fertile zones, the spines all being slender, and usually short, as compared with those of the typical form. The ovicells are broader than is usual in the typical form and differ in their sculpture (Fig. 48 C). A reticulate phase succeeds the radially striated phase, but its lines do not become generally and uniformly thickened as in the typical form. In older ovicells nodular thickenings appear on the lines and may be accompanied by punctate sculpture in the meshes. The figure shows the first indications of these thickenings. The pattern of the reticulation is variable. The meshes may be fairly regular and more or less hexa-

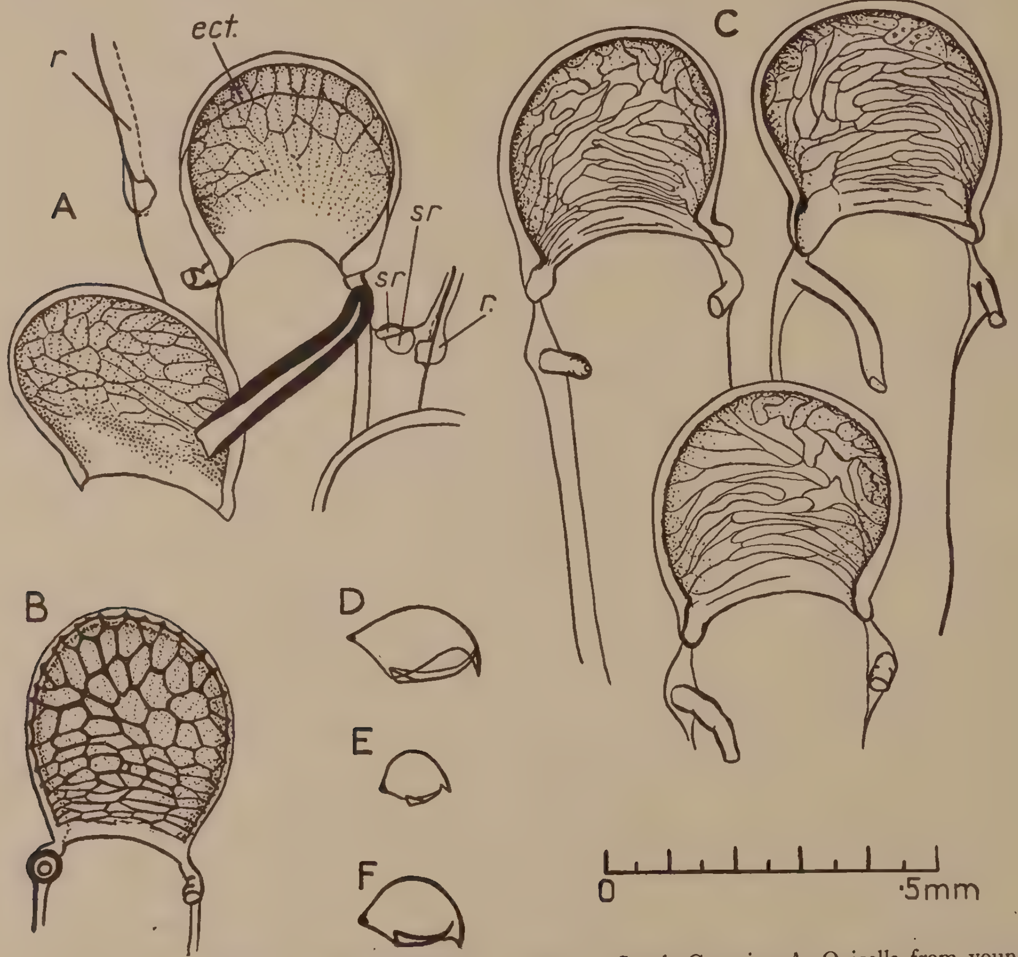

Fig. 48. A, B. *Camptoplites retiformis* (Kluge). St. WS 42, South Georgia. A. Ovicells from younger fertile zone showing stages in the development of the reticulation. One of the ovicells is seen obliquely. B. Fully calcified ovicell from the older fertile zone of the same colony. The spines are seen end-on. C. *C. retiformis* var. *tenuispina* var.n. St. 195, South Shetland Islands. Three zooecia with fully formed ovicells. D, E. *C. retiformis* var. *tenuispina* var.n. St. 363, South Sandwich Islands. Avicularia. F. *C. latus* (Kluge). St. TN 316, McMurdo Sound. Small avicularium for comparison with Fig. E. *ect.* edge of calcareous part of ectooecium, *r.* tip of a rootlet from another branch, *sr.* avicularian scar.

gonal as in the typical form, irregular (suggesting a jig-saw puzzle), or very narrow and elongated so that the whole pattern is reminiscent of a finger-print.

The small avicularia are a little longer in proportion to their height than those of the typical form (cf. Figs. 47 D, F and 48 E), and may be a little thickened and projecting where they are attached to the stalk. In these ways they approach those of *Camptoplites latus* (Fig. 48 F), but the lower head-angle is always less acute. The length of the down-turned beak is variable. The large avicularia are uncommon. The ovicells much resemble some of those of *C. latus* var. *aspera* (Fig. 50 B), but have not been seen to proceed to the thickened roughened stage in which the reticulation is obliterated. In other respects this form resembles *C. retiformis* rather than *C. latus*.

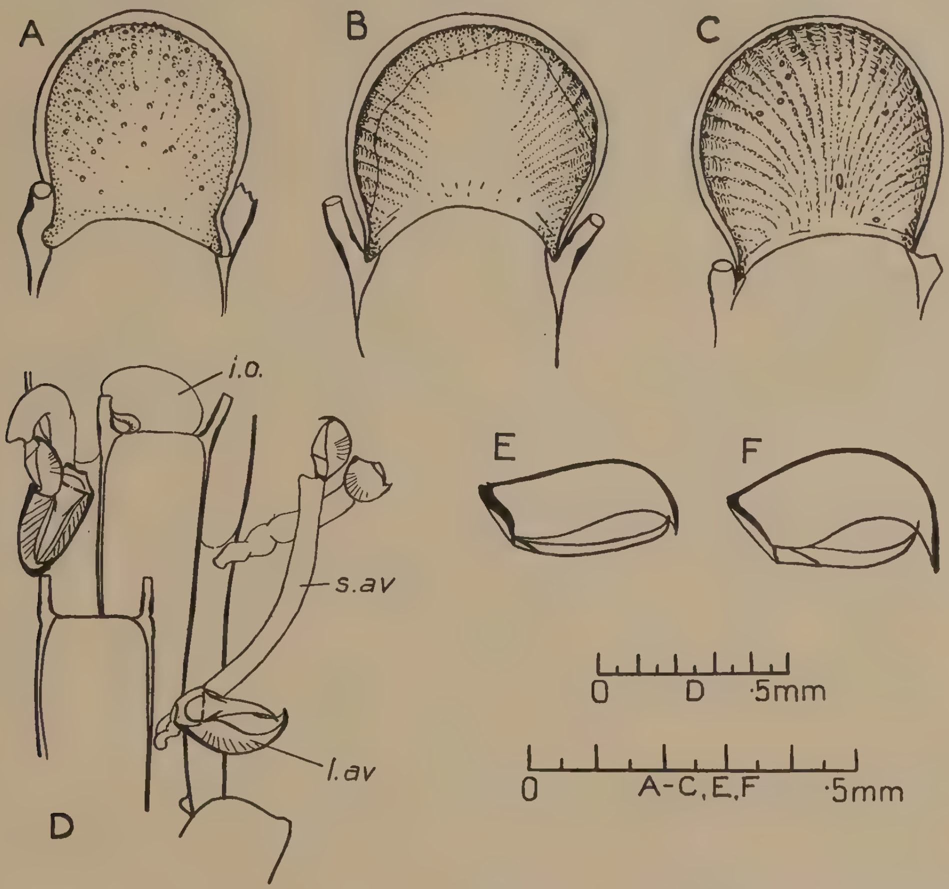

Fig. 49. A. *Camptoplites latus* (Kluge). St. TN 316, McMurdo Sound. Ovicell. B–D. *C. latus* var. *striata* var.n. St. 190, Palmer Archipelago. B. Incompletely calcified ovicell. C. Ovicell from 3rd fertile zone showing more advanced calcification. D. Triserial branch showing large avicularia on both inner and outer zooecia. E. *C. latus* var. *aspera* var.n. St. WS 42, South Georgia. Large avicularium. F. *C. latus* var. *striata* var.n. St. 190, Palmer Archipelago. Large avicularium.

i.o. incipient ovicell, *l.av.* large avicularium (short stalked), *s.av.* small avicularium.

13. Camptoplites latus (Kluge). Figs. 48 F, 49 A.

Bugula lata Kluge, 1914, p. 634, text-fig. 20.

Camptoplites latus, 1923, p. 300.

STATION DISTRIBUTION. *Antarctic:* Victoria Quadrant, St. 1652.

GEOGRAPHICAL DISTRIBUTION. Wilhelm II Land (Kluge); Ross Sea (Terra Nova; Discovery).

These specimens agree very closely with Kluge's account of *Camptoplites latus*. The radial sculpture, shown by him, is present in young ovicells, but later a punctate sculpture, consisting of small, widely spaced dots, is superimposed (Fig. 49 A).

C. latus is distinguished from *C. retiformis* by the shape of the zooecia, by the sculpture of the fully calcified ovicells, by the direction of the spines, by the exceedingly short stalks of the large avicularia, and by the acute lower head-angle of the small ones (cf. Figs. 47 D, F and 48 F). The small avicularia are less variable in size, the very small ones found in *C. retiformis* being absent in *C. latus*. Kluge's figures (fig. 20 and pl. xxviii, fig. 5) show most of the points of contrast very clearly.

14. Camptoplites latus var. striata var.n. Fig. 49 B–D, F.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, Sts. 190, 599.

GEOGRAPHICAL DISTRIBUTION. Palmer Archipelago; Adelaide Island (Discovery).

HOLOTYPE. St. 190, Palmer Archipelago.

This variety differs from *Camptoplites latus* in its ovicells and large avicularia. The ovicells are broader and show more marked radial striation, appearing almost fluted, and there is much less change with age (Fig. 49 B, C). In a colony with three fertile zones the fluting is the conspicuous sculpture of all the ovicells. A very faint reticulation can be discerned on a few ovicells of the two older zones, and also occasional dots, like those of typical *C. latus*, but this secondary sculpture is extremely inconspicuous. Although most of the ovicells in the second zone contain eggs or embryos, calcification of the ectooecium is only completed in the third zone.

The large avicularia (Fig. 49 F), which are short-stalked as in typical *C. latus*, are longer headed and are commonly found on the marginal zooecia (Fig. 49 D), whereas those of *C. latus* are only found on zooecia of the inner rows. In the shape of the zooecia and small avicularia, and in the position of the spines, var. *striata* resembles *C. latus*.

15. Camptoplites latus var. aspera var.n. Plate IX, fig. 4; Figs. 47 I, J, 49 E, 50 A–C.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, Sts. 45, 140, 149, WS 42.

GEOGRAPHICAL DISTRIBUTION. South Georgia (Discovery).

HOLOTYPE. St. WS 42.

This variety differs from *Camptoplites latus* in its ovicells and large avicularia, and in its spines, some of which are directed obliquely forwards while others point distally as in *C. latus*. When first formed the ovicells show distinct radial striation, but reticulation soon appears and gradually becomes very distinct, though not heavy as in *C. retiformis* (Fig. 50 B, C). Subsequently this reticulation is almost completely obliterated by a general thickening and roughening of the calcification (Fig. 50 A). The reticulation may be of the irregular, finger-print type (Fig. 50 B), also found in *C. retiformis* var. *tenuispina*, or more regular (Fig. 50 C) as in typical *C. retiformis*. Although approaching *C. retiformis* in this way, the variety is distinguished from it, and resembles *C. latus*, in the shape of the zooecia and of the small avicularia, and in the short stalks of the large avicularia (Fig. 50 A). In the large size and marginal position of the large avicularia, and the broader shape of the ovicells it resembles var. *striata*, but it differs from it in the shape of the large avicularia which are flatter dorsally and longer, as well as in the direction of the spines and the sculpture of the ovicells.

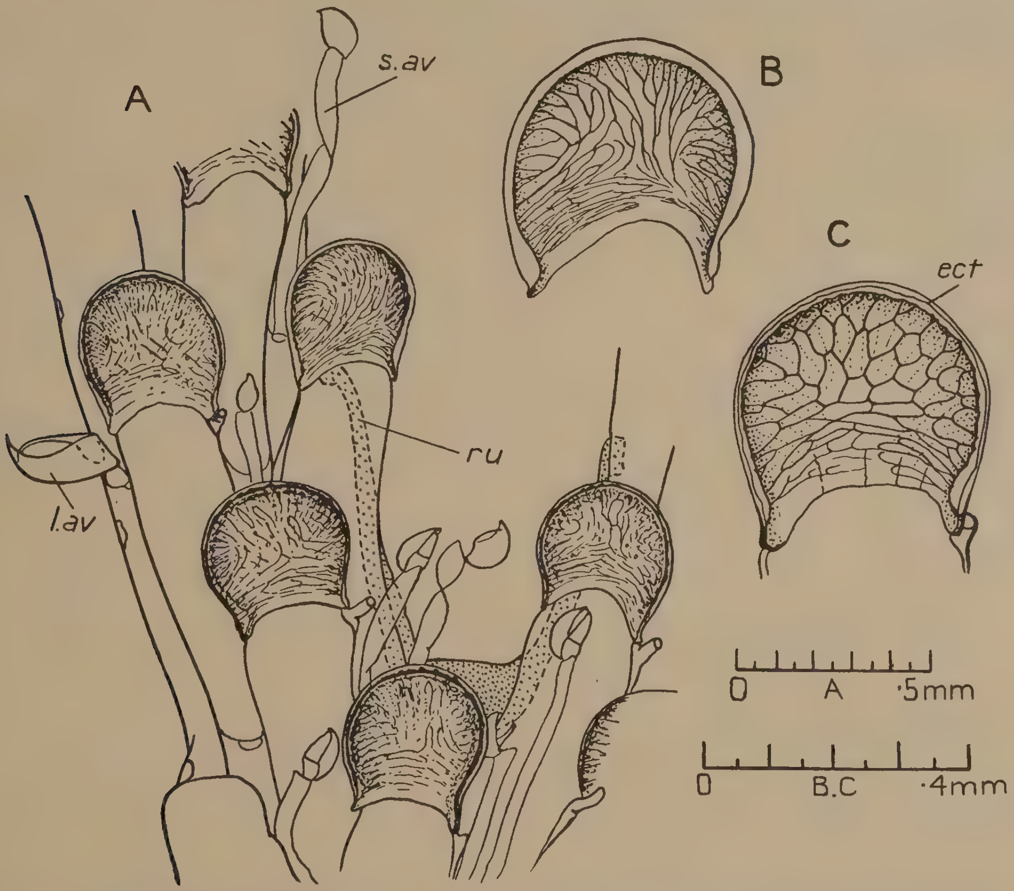

Fig. 50. *Camptoplites latus* var. *aspera* var.n. A, B. St. WS 42, South Georgia. A. Showing ovicells at a moderately advanced stage in the obliteration of the reticulation. Axillary chamber and runners stippled. Some zooecia have one small avicularium, others two. B. Ovicell from same colony showing an earlier stage of calcification. Slightly oblique view. C. St. 140, South Georgia. Ovicell with more regular reticulation.

ect. edge of calcareous part of ectooecium, *l.av.* marginal, short-stalked, large avicularium, *ru.* runner, *s.av.* long-stalked small avicularium.

The ovicells do not appear to be arranged in zones, but, as they were described from a longer branch than the three-zoned branches of var. *striata*, bearing ovicells throughout its length (Plate IX, fig. 4), and as marked differences in calcification were observed, they may be supposed to give a fair idea of the phases of calcification.

Fragments of a species of *Camptoplites*, judged from the shape of its zooecia and small avicularia to be one of the forms of *C. latus*, were taken by the 'Quest' at South Georgia (23.12.1.34, 36). Unfortunately, there are no large avicularia and no ovicells, but the small spines are directed frontally in some zooecia, distally in others, as in var. *aspera*, the only form of the species known from South Georgia. The fragments show an axillary rootlet with an elaborately branched terminal disk, and also the formation of a branch by regeneration from the distal part of a single damaged zooecium.

16. **Camptoplites atlanticus** sp.n. Figs. 40, 51 A–C.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. WS 93, WS 231, WS 773, WS 824.

GEOGRAPHICAL DISTRIBUTION. Patagonian Shelf, and off the shelf down to 293 m. (Discovery).

HOLOTYPE. St. WS 773.

DESCRIPTION. *Colony* with two to seven (or more?) series of zooecia, no secondary branches.

Rootlets arising from lateral and axillary chambers, both with runners (Fig. 51 A). Axillary chambers without rootlets also present. Cross-connexions common.

Zooecia with their distal ends raised and, in the marginal zooecia, turning away from the median line of the branch.

Spines absent.

Avicularia (Fig. 51 B) all of one kind, longer than high, the lower head-angle about 90°.

Ovicells (Fig. 51 C) about as wide as high with pronounced radial striation or fluting which shows no tendency to be superseded by other sculpture.

Ancestrula (Fig. 40) vase-shaped, with long opesia and short stalk, attached by roots, spineless (species **2**, p. 439).

REMARKS. This species is related to *Camptoplites latus*. It differs in the complete absence of spines throughout the colony, in the avicularia which are all of one kind and differ in shape from those found in *C. latus*, and in the ovicells in which the original radial striation is pronounced and, as far as the evidence goes, permanent. The avicularia are longer in proportion to their height than the small avicularia of *C. latus*, and the lower head-angle, which is acute in *C. latus*, measures about 90° (cf. Figs. 48 F and 51 B).

Three young colonies are attached to the type specimen. Each consists of an ancestrula and a few zooecia. The complete absence of spines even on these young colonies is remarkable. Avicularia, of typical shape, are present on the second and subsequent zooecia. The stalk of the ancestrula is very short as compared with other known ancestrulae of *Camptoplites*, and ends in two to four roots which may be symmetrically arranged, as in the figured specimen, or may be more irregular. Their tips, like those of the ordinary runners and rootlets of the adult colony, tend to be in contact with rosette-plates, but here they are the rosette-plates of the supporting colony. The connexion of a rootlet of one colony with the rosette-plate of another colony seems

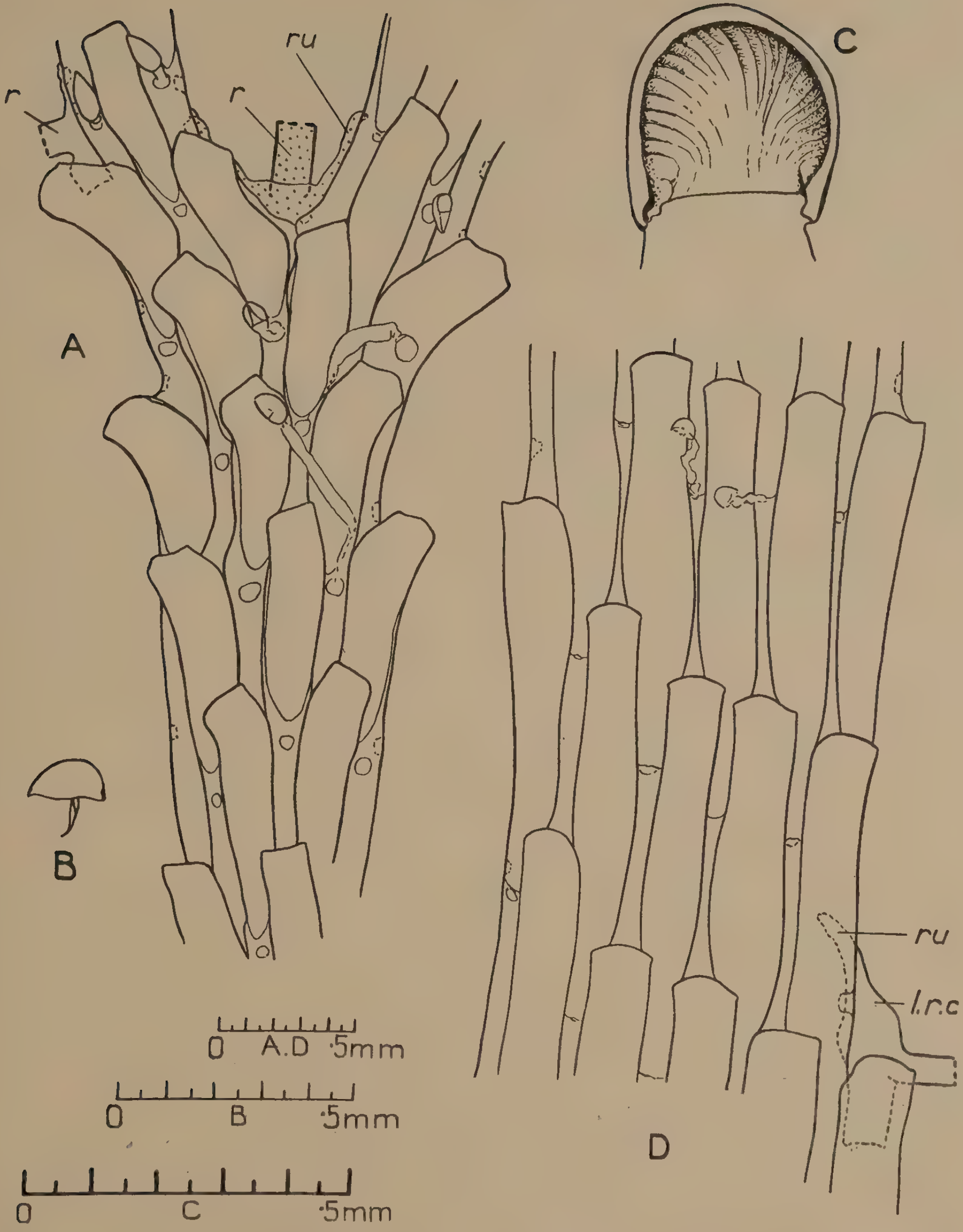

Fig. 51. A–C. *Camptoplites atlanticus* sp.n. St WS 773, off Patagonian Shelf. A. Part of zoarium. The proximal part of some of the avicularian stalks is obscure, but their place of attachment proximally to the opesia is very clear. Axillary chamber, with runners and rootlet, stippled. B. Avicularium. C. Ovicell. D. *C. rectilinearis* sp.n. St. TN 314, McMurdo Sound. Non-fertile zooecia. Most of the avicularia lost or broken. Avicularian scar at edge of gymnocyst of most zooecia.

l.r.c. lateral rootlet-chamber, *r.* rootlet, *ru.* runner.

remarkable. In the figured specimen three of the four roots end in contact with rosette-plates, and the fourth is apparently only prevented because two rootlets of the supporting colony are in the way. The seven young colonies examined have amongst them ten roots ending in contact with rosette-plates.

17. **Camptoplites rectilinearis sp.n.** Plate XII, fig. 4; Figs. 51 D, 52 A–D.

STATION DISTRIBUTION. *Antarctic:* Victoria Quadrant, St. 1660.

GEOGRAPHICAL DISTRIBUTION. Ross Sea (Terra Nova, Sts. TN 314, TN 339; Discovery).

HOLOTYPE. St. TN 339.

DESCRIPTION. *Colony* (Plate XII, fig. 4) consisting of long straight branches with many series of zooecia (eleven counted in some branches).

Rootlets arising from lateral and axillary chambers with runners, axillary rootlet arising from frontal or distal surface of chamber and projecting frontally (Fig. 52 A).

Zooecia very long and narrow (Fig. 51 D), with nearly straight sides, borders of aperture overlapping neighbouring zooecia very slightly. Marginal zooecia usually with outer distal corner pointed.

Spines present on some fertile zooecia, slender and directed frontally, otherwise absent.

Avicularia of two kinds both with moderate stalks (Figs. 52 A–C). Small ones round-headed with lower head-angle about 90°. Larger ones long-headed with lower head-angle acute, not so large as those of *Camptoplites retiformis* and *C. latus*.

Ovicells usually longer than wide, entooecium radially striated when young (Fig. 52 A), a slight roughening or punctate sculpture being superimposed later, ectooecium mostly uncalcified, its only frontal calcification (if any) being in its distal part (Fig. 52 D).

REMARKS. In basal view the lateral walls of the zooecia are nearly parallel throughout their length. In frontal view (Fig. 51 D) the straight-sidedness of the zooecia is less conspicuous because the borders of the aperture slightly overlap the neighbouring zooecia. The basal surface commonly bears fine transverse striations, which appear curved as they follow the contour of the wall, but these are sometimes, though less frequently, seen in related species.

It might be thought that the direction of the rootlets (in which *C. rectilinearis* agrees with *C. reticulatus* and *C. areolatus*) would depend on the position in which the particular colony was growing, but it is so consistent in the material of *Camptoplites* examined by me that I regard it as a specific character.

Branches with as many series of zooecia are found in *C. retiformis* and *C. latus*, and long narrow zooecia are sometimes seen, particularly in *C. retiformis*, but they are not usual in these species. In the direction (but not the distribution nor the size) of the spines, in the shape of the avicularia, and in the long stalks of the large avicularia, *C. rectilinearis* resembles *C. retiformis*. The ovicells are larger than those of either *C. retiformis* or *C. latus*, and differ from them in sculpture.

18. **Camptoplites reticulatus (Busk).** Figs. 53 C, 55 G, H.

Bugula reticulata Busk, 1881, p. 12, pl. i, figs. 7, 7*a*; 1884 (part), p. 40, pl. viii, figs. 3, 3*a*, 3*b*.
Camptoplites reticulatus Harmer, 1923, p. 300.

Station distribution. Not represented in the Discovery collections.

Geographical distribution. Off Valparaiso, 3953 m.; off Crozet Islands, 2928 m. (Busk).

Busk's figures were drawn from the material from Challenger St. 147 (Crozet Islands) which must be taken as the type. The slide figured by Busk is no. 99.7.1.284. Ovicells are abundant in this material, but were not figured. They are all at an advanced stage of development and no radial phase has been seen, the sculpture being coarsely punctate or papillate (Fig. 53 C). Busk only mentions one kind of avicularium, but the two types commonly found in the *reticulatus* group of *Camptoplites* (see p. 435) are present (Fig. 55 G, H).

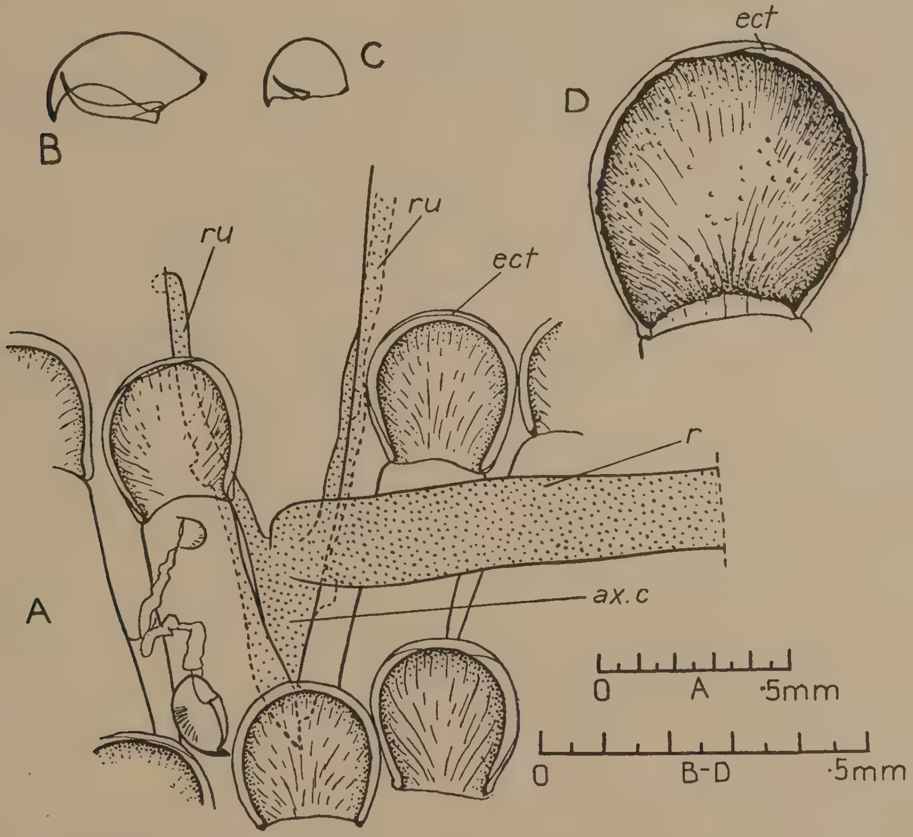

Fig. 52. *Camptoplites rectilinearis* sp.n. A. St. TN 339, Ross Sea. Bifurcation showing axillary chamber with runners and frontally directed rootlet. Ovicells young. B, C. Avicularia from same colony as Fig. A. D. St. TN 314, McMurdo Sound. Older ovicell.

ax.c. axillary chamber, *ect.* edge of calcareous part of ectooecium, *r.* rootlet, *ru.* runner. Axillary chamber, runners and rootlet stippled.

The specimen from Challenger St. 299 (off Valparaiso, 87.12.9.185) has neither spines nor ovicells. The specimens from Challenger St. 320 and St. 308 (see footnote, p. 466) belong to a distinct species described below as *C. asymmetricus*.

Busk distinguished a variety, *C. reticulatus* var. *unicornis*, by the presence of "a tubular cylindrical spine arising from the back near the top", but such spines are also present in the type material of the species. The spine was described by Busk as "probably only a modified or undeveloped connecting-tube", but it appears to be a true spine, and has not the chamber and runner found at the point of origin of the connecting tubes or rootlets. The species and the variety also resemble each other in the axillary rootlets which issue frontally. There is, however, a distinct difference in the shape of the zooecia which are more tapering in the variety, giving its branches a more sinuous outline. Busk figured an ovicell of var. *unicornis*, but shows no sculpture, and no complete ovicell is now to be found in his material of the variety.

As suggested by Kluge, it seems more probable that the Antarctic form, called *Bugula reticulata* by Waters (1904, p. 22), belonged to *C. areolatus* Kluge than to true *C. reticulatus*. *C. reticulatus* (Calvet) may also belong to *C. areolatus*, see pp. 455, 466. It is certainly distinct from *C. reticulatus* (Busk). For a discussion of *Bugula reticulata* var. *spinosa* Waters, see p. 441.

19. **Camptoplites lunatus** Harmer. Fig. 53 A, B.

Camptoplites lunatus Harmer, 1926, p. 452, pl. xxxiv, figs. 5–8.

Station distribution. Not represented in the Discovery collections.

Geographical distribution. South-west of Timor, 2050 m. (Harmer); off Crozet Islands, 2928 m. (1940.7.8.1).

A colony of this species, found unnamed among material from Challenger St. 147 (Crozet Islands), agrees very closely with Harmer's description. The lateral rootlets, which spring from chambers without runners, form cross-connexions making the colony reticulate.

The zooecia are rather long and slender. The expanded part bearing the opesia forms about half their length and the narrow, tubular, proximal half is not conspicuous. The zooecia have two rather stout spines. One is placed distally on the basal surface in the mid-line of the operculum which is oblique in non-fertile zooecia, matching the obliquity of the distal end of the zooecium. The other spine is on the outer distal corner, directed frontally. Spines in these positions are shown in Harmer's figures. The forward direction of the outer distal corner and its spine is evidently natural and is the cause of the tendency to unnatural inward folding of the corner noticed by Harmer. The spines have a flexible zone at their base. As noted by Harmer the distal spine may be replaced by a rootlet-chamber.

Very large, delicately calcified ovicells are present, and are the largest known in *Camptoplites* (cf. Fig. 53 A, B with Figs. 48 A–C, 49 A–C, 50 B, C, 51 C, 52 D, 53 C, D, 54 B, D, all drawn to the same scale). The entooecium bears radial sculpture with fine transverse striations and has an out-turned lip. The greater part of the basal surface of the ovicells is free from the distal zooecium and is fluted like the frontal surface. The outer distal spine is present on fertile zooecia. The basal spine may also be present and underlies the ovicell.

The thin axillary rootlets of *C. lunatus*, adhering to the basal surface of the branch, are in striking contrast to the stout, free axillary rootlets of other species of *Camptoplites*.

The Challenger specimen was only discovered after the portion of the type-specimen deposited in the British Museum had been despatched to a place of safety, and the main part of the type-colony at Amsterdam was also not available for examination owing to the war. The British Museum type-specimen had, however, been examined several years before during the preparation of the rest of this account of *Camptoplites*.

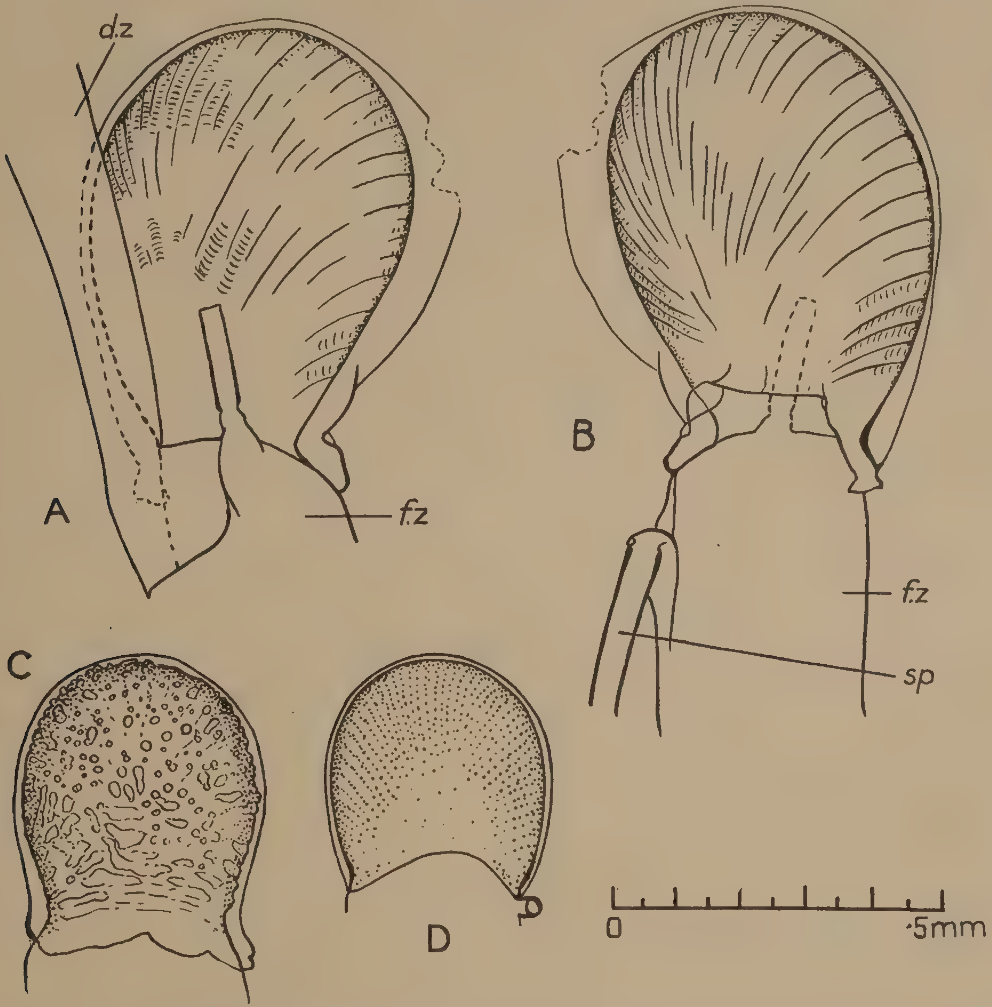

Fig. 53. A, B. *Camptoplites lunatus* Harmer. 1940.7.8.1. Challenger St. 147, off Crozet Islands. The same ovicell in oblique basal and frontal views. There is a break in the ectooecium. C. *C. reticulatus* (Busk). 87.12.9.187. Challenger St. 147, off Crozet Islands. Ovicell from type-specimen. D. *C. asymmetricus* sp.n. 87.12.9.188[1]. Challenger St. 320, off Patagonian Shelf. Ovicell from paratype-specimen.

d.z. distal zooecium, *f.z.* fertile zooecium, *sp.* spine.

20. Camptoplites areolatus (Kluge). Figs. 54 A, B, 55 A, B.

Bugula areolata Kluge, 1914, p. 627, pl. xxviii, fig. 3, text-fig. 13.

Camptoplites areolatus Harmer, 1923, p. 300.

? *Bugula* sp. var. *variospinosa* Kluge, 1914, p. 628, pl. xxviii, fig. 4.

? *Bugula reticulata* Waters, 1904, p. 22; Calvet, 1909, p. 7, pl. i, fig. 3.

STATION DISTRIBUTION. *Antarctic:* Weddell Quadrant, St. 175.

GEOGRAPHICAL DISTRIBUTION. South Shetland Islands (Discovery); Palmer Archipelago ? (Calvet); Bellingshausen Sea ? (Waters); Wilhelm II Land (Kluge); Oates Land (Terra Nova).

These small specimens from the Antarctic agree very well with Kluge's account of *Camptoplites areolatus*. There is usually a flexible zone or incipient joint at the base of the branch, passing proximally to the opesia of the inner zooecium. The ovicells are radially striated at first, but in one or two, on Discovery fragments, a faint trace of superimposed reticulation can be seen (Fig. 54 B), and this calcification had evidently proceeded further in Kluge's material. If Kluge is right in attributing *C. reticulatus* (Calvet, 1909, pl. i, fig. 3, not Busk) to this species the reticulation must eventually become thick and heavy as in *C. retiformis*, a species which Calvet's figure might well represent (see p. 455).

C. retiformis and *C. areolatus* also resemble each other in their avicularia which are similar in general shape (cf. Figs. 47 A–G and 55 A, B). *C. areolatus* differs from *C. retiformis* in its biserial, jointed colony, in the presence of a second outer distal spine on many zooecia and in the possession of a cryptocyst.

The Antarctic form identified by Waters with *C. reticulatus* probably belonged to this species, as suggested by Kluge, but Busk's South Atlantic specimens appear to be distinct from both (see *C. asymmetricus*, below).

C. areolatus and *C. asymmetricus* clearly belong to *Camptoplites*, for they have the characteristic stalked avicularia, and axillary rootlets arising from chambers with runners. The zooecia are rather more calcified than those of other species of *Camptoplites* and their shape is reminiscent of the Scrupocellariidae, especially of some species of *Notoplites*. This resemblance is increased by the tendency to form joints (Fig. 54 C), and by the presence of a line of lateral oval areas (Fig. 54 B, D) which are, however, also to be seen in *C. bicornis* var. *quadriavicularis* (see p. 449).

Var. *variospinosa* (Kluge) was described from two small colonies and a fragment. One of the colonies had an ancestrula. They differed from the typical form in the greater number of spines, in the shape of the zooecia which were considerably wider distally, and in possessing only one kind of avicularium, but these are juvenile features, and it seems probable that var. *variospinosa* is no more than the young colony of typical *C. areolatus*. *Bugula reticulata* var. *spinosa* Waters (1904, p. 22), given by Kluge as a doubtful synonym of var. *variospinosa*, appears to be the young colony of some other species (see p. 441).

21. **Camptoplites asymmetricus** sp.n. Figs. 53 D, 54 C, D, 55 C–F.

Bugula reticulata Busk (part), 1884, p. 40 (not figured).

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, St. WS 840. *Antarctic:* Weddell Quadrant, St. 156.

GEOGRAPHICAL DISTRIBUTION. Off Patagonian Shelf below 400 m. (Busk; Discovery); Chile (Busk); South Georgia (Discovery).

HOLOTYPE. Challenger, St. 320, 1098 m., 87.12.9.188.

PARATYPES. Challenger, St. 320, 1098 m., 87.12.9.184, 99.7.1.283, 34.11.12.11, Challenger, St. 308[1], 320 m., 87.12.9.186.

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[1] This is wrongly given in the Challenger Report as St. 303 (see Murray, 1895, p. 1138).

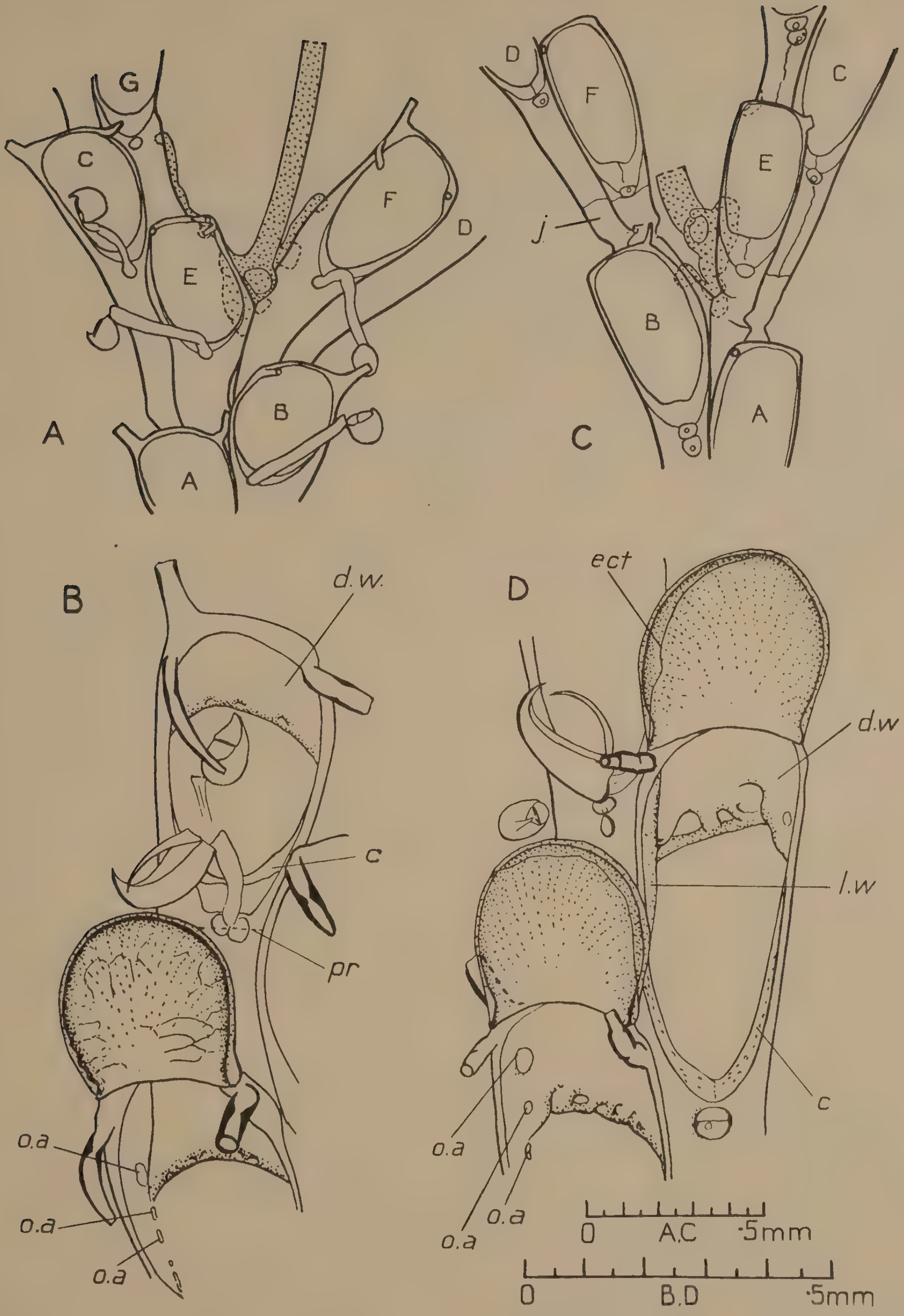

Fig. 54. A, B. *Camptoplites areolatus* (Kluge). St. 175, South Shetland Islands. A. Bifurcation in frontal view. This bifurcation is near the top of the branch. An older one would show more distinct flexible zones or incipient joints. B. Two zooecia and an ovicell. The stalk of the small avicularium is partly indistinguishable though its point of attachment beside the large avicularium is clearly visible. The thickened edge of the cryptocyst is outlined. C, D. *C. asymmetricus* sp.n. C. 87.12.9.188[1]. Challenger St. 320, off Patagonian Shelf. Bifurcation in frontal view. D. St. 156, South Georgia. The stalks of the avicularia are invisible. The second outer distal spine underlies the ovicell.

In Figs. A and C the zooecia are lettered according to Harmer's scheme and the axillary chamber, runners and rootlet are stippled. *c.* cryptocyst, *d.w.* distal wall, *ect.* edge of calcified part of ectooecium, *j.* joint, *l.w.* lateral wall, *o.a.* lateral oval areas, *pr.* position of projection from basal wall (indicated by dotted line).

Description. This species differs from *Camptoplites areolatus* (Kluge) in the absence of the calcareous projection from the basal wall ("kleine halbmondformige, kalkige querscheide" of Kluge), in the asymmetrical origin of the axillary rootlets, in the longer opesia, in the shape of the larger type of avicularium, and in the ovicells.

In *C. areolatus* zooecia E and F at the bifurcation are in contact for some distance (Fig. 54 A), the actual bifurcation occurring at about the level of the proximal end of the opesia of zooecium E (lettering as in Harmer, 1923). When an axillary rootlet is formed it arises from the usual type of symmetrical, more or less triangular, axillary chamber, with a pair of distal runners. In *C. asymmetricus* zooecia E and F are only joined by a small proximal connecting process, the bifurcation occurring beside the opesia of zooecium B (Fig. 54 C). The axillary chamber takes the form of a tube running from the axil along the side of zooecium E and giving rise to a rootlet at a point nearly half way along the side of the zooecium. A runner is sometimes formed and passes along the side of zooecium F. The greater separation of zooecia E and F and the condition of the axillary chamber may perhaps be correlated with the more complete differentiation of the joints in *C. asymmetricus*, if this difference in the joints proves to be a constant feature when more material is examined.

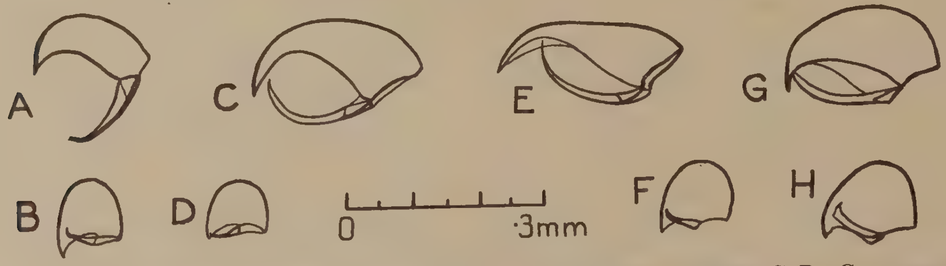

Fig. 55. A, B. *Camptoplites areolatus* (Kluge) St. 175, South Shetland Islands. C, D. *C. asymmetricus* sp.n. 87.12.9.188^{3}. Challenger St. 320, off Patagonian Shelf. E, F. *C. asymmetricus* sp.n. St. 156, South Georgia. G, H. *C. reticulatus* (Busk). 87.12.9.187. Challenger St. 147, off Crozet Islands. Avicularia.

The large avicularia are a little longer and less curved than those of *C. areolatus* (cf. Fig. 55 A, C and E), this flattening of the head being particularly marked in the specimen from South Georgia (Fig. 55 E).

The ovicells show a faint, fine, radial striation on the entooecium (Figs. 53 D, 54 D). In the material that I have examined there is no sign of this being superseded by any other sculpture, and the ectooecium remains incompletely calcified.

In both *C. asymmetricus* and *C. areolatus* the distal communication pores are more irregular in size, shape and number than Kluge supposed, and there is a tendency to thickening of the intervening portions of the wall (Fig. 54 B, D).

The Challenger specimens, which have been made the types of *C. asymmetricus*, were included in *Bugula reticulata* by Busk. They differ from the type-specimen of that species in the presence of joints, in the asymmetrical axillary rootlet-chambers and the absence of runners from the lateral chambers, in the presence of a cryptocyst, and, as far as the evidence goes at present, in the smaller size and simple radial sculpture of the ovicells (cf. Fig. 53 C and D).

Erymophora gen.n.

Genotype. *Brettia pellucida* var. *gracilis* Nichols, 1911, p. 7, pl. i, figs. 1–3.

Definition. Zoarium erect, uniserial. Branches originating as lateral buds and projecting at right angles to branch, usually connected by a tube with zooecium proximal to parent zooecium. Zooecia tubular and jointed proximally, expanded distally. Opesia membraniporine, oval, with narrow cryptocyst. Avicularia (when present) stalked, capitate, attached medianly to distal wall, mandible rounded. Ovicells (only known in genotype) hyperstomial.

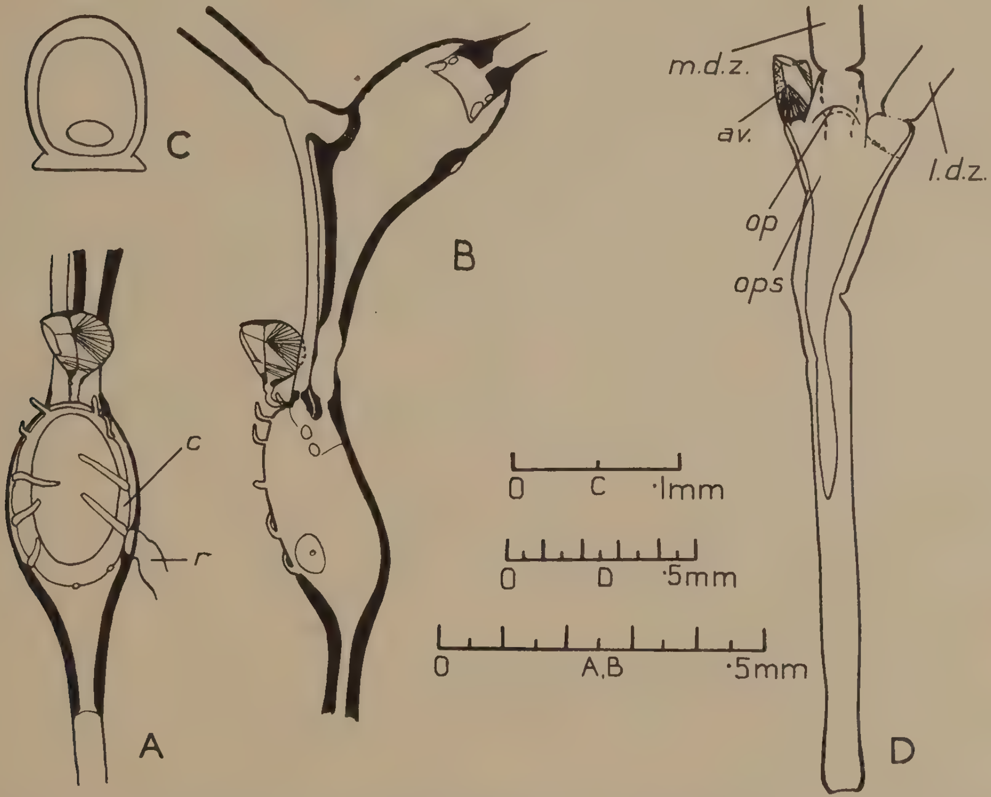

Fig. 56. A–C. *Erymophora* sp. indet. Specimen received from Professor Hickson from the Terra Nova collection. Locality unknown. A. Frontal view. B. Basal view, with the proximal zooecium twisted into an oblique view in mounting. C. Mandible. D. *Brettia triplex* sp.n. St. TN 194, off Oates Land. One rather crumpled zooecium.

av. avicularium, *c.* cryptocyst, *l.d.z.* lateral distal zooecium, *m.d.z.* median distal zooecium, *op.* operculum, *ops.* opesia, *r.* rootlet.

Remarks. This genus is included in the Bicellariellidae on the evidence of a small specimen bearing stalked avicularia found by Professor Hickson among Terra Nova material from an unknown locality (Fig. 56 A–C). The avicularia resemble those of other Bicellariellidae except for their blunt mandible. The zooecia agree very exactly with those of the genotype. There are no ovicells. It is possible that this specimen actually belongs to *Erymophora gracilis*, but, in the absence of ovicells and of any information about the locality, this point must remain unsettled. The only samples of the Atlantic bottom fauna taken by the 'Terra Nova' came from 229 m. and 73 m. off Brazil (Sts. TN 38 and TN 42), whereas the type-specimen of *E. gracilis* was taken in 1295–1299 m. (707–710 fm.) off south-west Ireland.

E. gracilis was described as a species of *Brettia*, but the zooecia not only differ from those of *Brettia* in the presence of avicularia, but also in being well calcified and having a cryptocyst and helmet-shaped ovicell. It is thus unlikely to belong to *Corynoporella* Hincks (1888, p. 215), which is described as resembling typical *Brettia* except for the presence of avicularia. I have not seen a specimen of the genotype *Corynoporella tenuis*. *Erymophora gracilis* is further distinguished from *Corynoporella* by its branching. The lateral origin of the branches is not in itself a valid distinction, *Notoplites tenuis* var. *uniserialis*, for example, forms branches both by lateral buds and by paired distal buds (see p. 351), but the tubular connexion is a peculiar feature. The origin of the tube from the lateral zooecium might be compared to the origin of a rootlet, though there is unrestricted communication between the cavity of the zooecium and that of the tube. It is not, however, just a rootlet attached to another zooecium by its tip, for the connexion between its other end and the proximal zooecium is like that between two zooecia, so that it appears as if the parent zooecium had produced two distal buds. Such an arrangement is difficult to interpret, but as it is found in *Erymophora gracilis*, *E. klugei* and in the unnamed Terra Nova specimen, it appears to be a character of some importance.

Allantopora Lang (1914, p. 436), the membraniporine genus to which *Erymophora gracilis* has been compared (Harmer, 1926, p. 225, and footnote, p. 198), differs in its branching, is not known to have avicularia, and is encrusting.

1. **Erymophora gracilis** (Nichols).

Brettia pellucida var. *gracilis* Nichols, 1911, p. 7, pl. i, figs. 1–3.

STATION DISTRIBUTION. Not represented in the Discovery collections.

GEOGRAPHICAL DISTRIBUTION. 51° 15′ N, 11° 47′ W, 707–710 fm., off south-west Ireland (Nichols).

Part of Nichols's type material, unfortunately without ovicells, is in the British Museum (11.10.1.851). I have nothing to add to Nichols's description. The Terra Nova specimen described above (Fig. 56 A–C) may belong to this species.

2. **Erymophora klugei** sp.n.

Brettia sp. Kluge, 1914, p. 642, text-fig. 24.

? *Brettia longa* (part) Waters, 1904, pl. i, fig. 2*a*.

STATION DISTRIBUTION. *Antarctic*: Weddell Quadrant, St. 1948.

GEOGRAPHICAL DISTRIBUTION. Near Elephant Island (Discovery); Bellingshausen Sea? (Waters); Wilhelm II Land (Kluge); Oates Land (Terra Nova).

HOLOTYPE. Kluge's figured specimen, which I have not seen, becomes the holotype.

This Antarctic species is only known from scanty fragments. It agrees with *Erymophora gracilis* in its zoarial characters, having zooecia of similar shape and the same curious longitudinal connexion between the lateral branch and the proximal zooecium. It has a wider cryptocyst and, instead of the series of marginal spines, it has at most four short distal spines. Ovicells and avicularia are unknown. The Discovery material consists of a few dead zooecia, found imbedded in a sponge, and does not show any of the curious tubular connexions.

Kluge showed that Waters confused two species in *Brettia longa*, one of which may be the species here called *Erymophora klugei*. He restricted Waters's name to the other species, discussed above under *Notoplites tenuis* var. *uniserialis* (p. 352).

Aetea Lamouroux, 1812

1. **Aetea anguina** (Linnaeus). Fig. 57 A–C.

Sertularia anguina Linnaeus, 1758, p. 816.

Aetea anguina Busk, 1884, p. 2; Marcus, 1921*a*, text-fig. 15; Harmer, 1926, p. 194, pl. xiii, figs. 3, 4 (synonymy); Hastings, 1932, p. 408; Hasenbank, 1932, p. 324; Osburn, 1933, p. 306, pl. xv, fig. 12; Marcus, 1937, p. 26, pl. v, fig. 8; Livingstone, 1937, p. 377; Marcus, 1938*b*, p. 199; Neviani, 1939, p. 14.

STATION DISTRIBUTION. *Sub-Antarctic:* South Atlantic Ocean, Sts. 4, 399, 1187, 1902, WS 84, WS 847. *Victoria:* St. 1686.

GEOGRAPHICAL DISTRIBUTION. Throughout tropical and temperate regions including: Chile (Busk); Brazil; Juan Fernandez (Marcus); Tristan da Cunha (Busk; Discovery); Gough Island; Patagonian Shelf (Discovery); South Africa (Hasenbank).

Busk (1852*b*, p. 31) recorded this species from the "Antarctic Ocean", but there is no trace of any specimen on which he might have based his statement, nor any authority for it in the earlier writings that he lists. The 'Discovery' did not find the genus farther south than the Falkland Islands. Waters (1904, p. 20) recorded three or four zooecia of an unnamed *Aetea*, resembling *A. recta*, from "Tangles VIII"[1] in 70° S, but the other Antarctic expeditions whose reports have been published did not find the genus at any Antarctic station. I therefore regard the existence of *Aetea* in the Antarctic as still somewhat dubious. Marcus (1938*b*) came to a similar conclusion.

The material from St. 1902 (Patagonian coast) comprises small colonies on a hydroid and on seaweed. Those on the weed have a shorter, broader opesia with its proximal edge tending to turn outwards, but both forms fall within the range of *A. anguina* as generally understood. The erect part of the zooecia of both is curved.

In some of the specimens from Tristan, notably those from St. 1187, 18 November 1933, a membranous sac is frequently to be seen placed symmetrically on the frontal membrane, proximally to the operculum, and containing an embryo (Fig. 57 A). No opening to the sac could be detected. The frontal membrane is strongly depressed in these preserved specimens, and, where the embryo is small, the whole sac lies in the hollow so formed without projecting beyond the borders of the opesia as seen in profile. At this stage the sac is so closely applied to the membrane that its basal wall cannot be discerned as distinct from the membrane. With larger embryos the sac projects as shown in Fig. 57 A, but is still in close contact with the frontal membrane. Two sacs with large and apparently advanced embryos are free from the membrane except for a distal attachment proximal to the operculum (Fig. 57 B), and an empty shrivelled sac has a similar attachment (Fig. 57 C). In this last specimen the frontal membrane is mainly convex, but shows a well-marked depression where the sac may be presumed to have rested at an earlier stage. This depression is, however, not to be seen in the specimen shown in Fig. 57 B.

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[1] He gives the number 986 which does not appear in his lists on pp. 3 and 15.

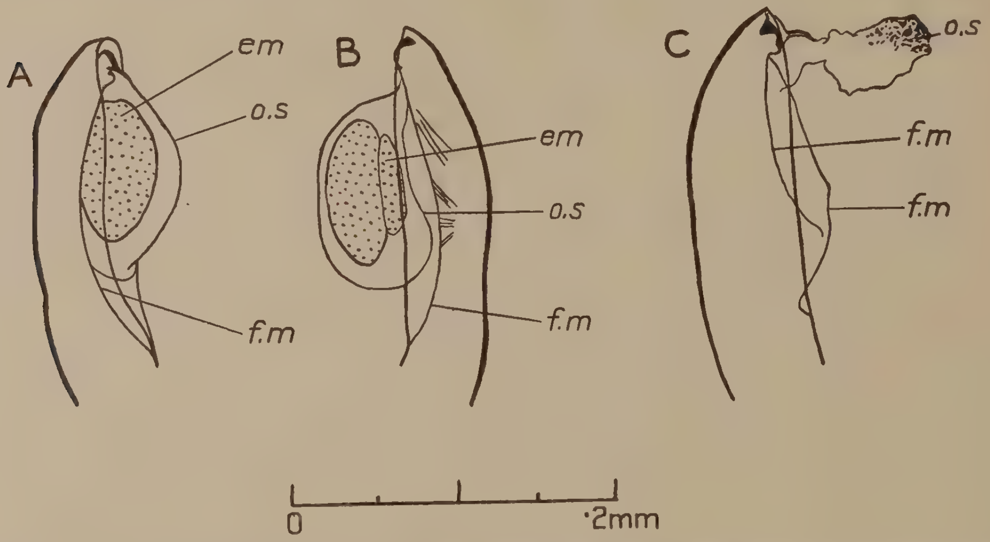

Fig. 57. A–C. *Aetea anguina* (Linnaeus). St. 1187, Tristan da Cunha. Distal ends of zooecia showing supposed ovisacs. Sculpture omitted. A. Ovisac closely appressed to frontal membrane. B. Ovisac free from frontal membrane, embryo more advanced than in A. C. Ovisac empty and shrivelled. *em.* embryo (stippled), *f.m.* frontal membrane, *o.s.* ovisac.

I have seen the sacs in fifty-nine zooecia, and their constantly symmetrical position and absence from other parts of the zooecium give a very strong impression that they are part of the Polyzoan, and not the attached egg-capsule of another animal. On the other hand it is difficult to reconcile these observations with those of Waters (1913, p. 463), Osburn (1912, p. 220) and Marcus (1937, p. 27) of distal embryo-sacs in this species. The older, partly detached, sacs somewhat resemble those of Osburn and Marcus, but the attachment in my material is certainly proximal to the orifice. In Waters's figure the ovisac is shown as a spherical vesicle attached to the calcareous wall and unconnected with the aperture. In view of the resemblance between the ovisacs of *Aetea* and those of such Ctenostomes as *Nolella* (see Harmer, 1926, p. 193) it might be suggested that their position is indeterminate were it not found to be so constant in any one batch of material.

The frontal ovisacs appear to be the "membranous bags" described by Robertson (1905, p. 245) as "ooecia". The apparently asymmetrical position of the sac in her figure is, I think, due to the omission of the nearer calcareous wall of the head of the zooecium, which would have been visible at a higher focus. In my material the cells are more closely packed, but an embryo with loosely packed, rounded cells, as in that figure, might be found at a different stage of segmentation.

Marcus (1937, p. 28) made the suggestion, warranted by the figure, that the structures seen by Robertson were algae such as he had found attached to his own material in various positions. The contents of the sacs in my specimens are certainly animal embryos, though I do not know whether they are Polyzoan. It is, however, worth noticing that the most advanced embryo resembles many Polyzoan larvae in shape (Fig. 57 B). Despite his suggestion that Robertson's ovisacs were algae Marcus later (1938*b*) regarded the form with frontal ovisacs as a distinct species, but the very close agreement in other characters seems to preclude this separation.

Examination of zooecia stained with borax carmine (without decalcification) and mounted in canada balsam has shown me beyond doubt that the spots on the walls are pores, as described by Levinsen, not protuberances. The examination of the optical section of the wall as seen at the periphery of a profile view proves this, for the fine tubes or passages can be seen, corresponding to the dots and passing through the thickness of the wall at right angles to the surface. Moreover, examination of the annulated part in optical section shows which of the alternating rings are calcareous and which not, the calcareous ones being thicker in section. The calcareous rings have a slightly more opaque, greyer appearance than the non-calcareous ones, and they exactly match the wall between the dots in colour and texture. The fusion of dots to form linear marks and then rings, as described by Marcus, is to be seen, but the rings so formed are the non-calcareous ones, as might be expected from the fusion of pores.

2. **Aetea curta** Jullien. Plate XIII, fig. 1; Fig. 58 A, B.

Aetea curta Jullien, 1888, p. 26.

? *Aetea truncata* Marcus, 1938*a*, p. 11, pl. i, fig. 4.

STATION DISTRIBUTION. *Ascension Island:* St. 1.

GEOGRAPHICAL DISTRIBUTION. Magellanic Region (Jullien); Brazil? (Marcus); Ascension Island (Discovery).

A specimen of *Aetea* from Ascension Island has zooecia in which the erect part is shorter than the encrusting part, and the opesia nearly always occupies more than half the length of the erect part (Fig. 58 A, B). The encrusting part tapers at the proximal end, but for at least half its length it is dilated and wider than the erect part. The erect part is relatively of very uniform width, and may be somewhat curved. The surface of the zooecia is very finely punctate almost throughout, only the extreme proximal end of the encrusting part appearing smooth. In this species, as in *A. anguina*, the punctations are pores. This is particularly clearly seen at the broken edge of a piece of the wall mounted in balsam, and can also be deduced from the appearance of the optical section of the wall seen at the periphery of mounted specimens. The pores are much smaller than those of *A. anguina*. In addition to the pores the encrusting part and the tubular erect part, below the opesia, may be annulated. These annulations are undulations of the whole punctate wall, and must not be confused with the rings sculptured on the surface of the wall in *A. anguina* and *A. recta*. Zooeciules and appendages are present, as in *A. truncata* (see Harmer, 1926, p. 197), and the zooecia have the truncate distal end and oblique operculum of that species.

British specimens of *A. truncata*, including two preparations from Landsborough's material from Arran (99.7.1.566, 567, presumably part of the type-material), differ from these Ascension Island specimens in various ways (cf. Plate XIII, figs. 1 and 2). The zooecia are smaller and more slender. The erect part is very straight and markedly tapering proximally, as shown in Hincks's figures (1880, pl. i, figs. 8–11; pl. ii, fig. 3). The opesia usually occupies less than half the length of the erect part. The encrusting part is narrower than the erect part, threadlike for the greater part of its length, and usually even longer in proportion to the erect part than is that of the Ascension Island specimens. There is no trace of annulation. I have seen neither zooeciules nor appendages in British specimens, but they might be found if more material were examined. The relative lengths of the various parts vary to some extent probably with conditions of growth, but the differences in shape and absolute size make the Ascension Island form clearly distinguishable from typical British *A. truncata*.

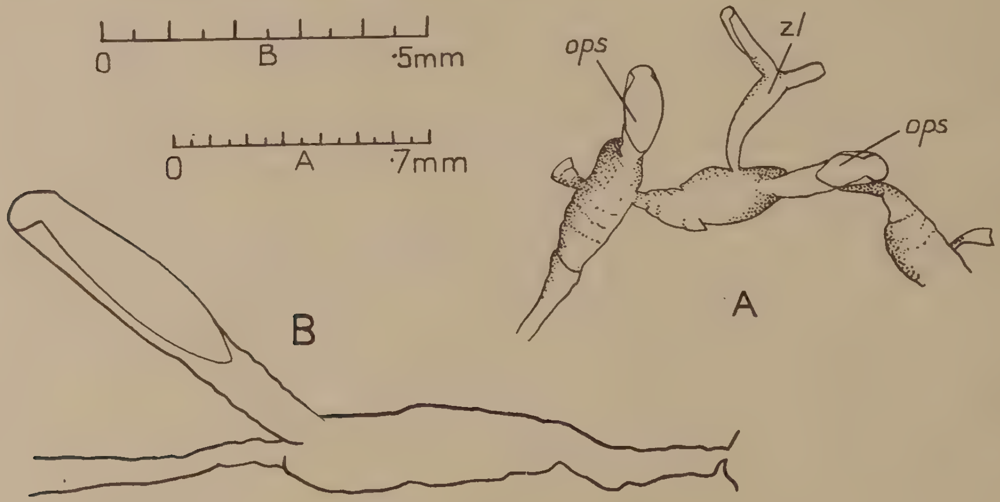

Fig. 58. *Aetea curta* Jullien. St. 1, Ascension Island. A. Dry specimen, seen by reflected light. Erect parts much foreshortened. B. One zooecium and parts of adjacent ones in an oblique frontal view. *ops.* opesia, *zl.* zooeciule.

On this argument many of the specimens from various parts of the world, recorded as *A. truncata*, would be distinct from the British species, and I think this is probably so. Marcus's figure of his *A. truncata* shows most of the features of the Ascension Island species.

It remains to consider whether the Ascension Island form can be identified with any described species. Jullien described *A. curta* as having the "pédoncule" (i.e. the tubular portion of the erect part) punctate and "annelé", and the rest of the zooecium punctate. It is clear from his account of the striations of his next species (*A. australis*) that they were of the same type as those of *A. recta*, and that in *A. curta* he was describing something more coarse. The Ascension Island form thus agrees with *A. curta* in being punctate all over and partially annulated, and in the shortness of its erect part, but the annulations extend to the encrusting part, which is wider than the erect part. In *A. curta* these parts were of the same width. The opesia is a little longer in proportion to the rest of the erect part, but this relation is variable, and, as we have already seen, may alter with growth. On the whole I am inclined to identify the Ascension Island specimens with *A. curta*.

A. curta may, however, be a synonym of *A. ligulata* Busk. That species also has punctate zooecia with coarse annulation on the tubular erect part, and zooeciules and appendages are present (Marcus, 1937, pl. iv, fig. 10). A constriction below the opesia is to be seen in some dried zooecia from the Ascension Island colony of *A. curta*, but it is clearly the result of drying. To judge from Marcus's figure the constriction in *A. ligulata* is not due to drying, for it is well marked in a zooecium with extended tentacles. The opesia is much shorter, and the tubular erect part longer in proportion to the other parts of the zooecium than in the Ascension Island specimens, but this, as we have said, may depend on age. Marcus suggested that the absence of punctation on the thread-like proximal part in *A. curta* might be a distinction, but this character is difficult to establish with certainty and, where the punctations appear to be absent, only a very small area at the extreme proximal end is affected, so that I doubt whether it is a distinction of any importance. Thus it may well be found that *A. ligulata* includes *A. curta* in its range of variation. As they were both originally described from the southern extremity of South America, this conclusion is the more probable. On the other hand, Marcus gives good evidence for the existence of two species in Brazilian waters, namely, *A. ligulata* and his *A. truncata* (which differs from the British form and may be *A. curta*).

On the strength of my examination of the type material of *A. crosslandi* Waters (1910, p. 253) lent by the Manchester Museum, Marcus (1937, p. 30) has included that species in the synonymy of *A. ligulata*. Fragments from Mauritius (86.2.5.53) appear to belong to this species. I should also include the specimens from the Panama region recorded by me as *A. truncata* (Hastings, 1930, p. 702), and it is possible that some other records of *A. truncata* in the tropics may be based on *A. ligulata*.

A. fuegensis Jullien (1888, p. 25) described from a single mounted specimen, appears to have had the same combination of fine spots and coarse annulation, but it had a peculiar prolongation of the zooecium beyond the orifice. It has not been redescribed. Vallentin (1924, p. 373) believed that he had recognized it, but there is no specimen of *Aetea* in his Falkland Island collection, which is now in the British Museum.

Scruparia Oken, 1815

1. **Scruparia ambigua (d'Orbigny).**

Eucratea ambigua d'Orbigny, 1841, pl. iii, figs. 13–17, 1847, p. 11.

Scruparia ambigua Hastings, 1941, p. 470, text-fig. 2 A, B (synonymy).

Station distribution. *Sub-Antarctic:* South Atlantic Ocean, Sts. 222, 1902, WS 95, WS 847. *Victoria:* St. 1686.

Geographical distribution. South-west and west of Great Britain; Ireland; France; Norway; ? Sweden; Adriatic; Patagonian Shelf; Magellanic Region; Amsterdam Island, Indian Ocean; Australia; Tasmania; New Zealand; California; Galapagos Islands.

The sources of the recorded distribution are given by Hastings. Eight ancestrulae were taken at St. WS 847, near the Patagonian coast, on 2 September 1932.

Brettia Dyster, 1858

1. Brettia inornata (Goldstein).

Alysidium inornata (sic) Goldstein, 1882, p. 42, pl. i, fig. 1.

Catenaria attenuata Busk, 1884, p. 14, pl. ii, figs. 1, 1*a*.

Station distribution. Not represented in the Discovery collections.

Geographical distribution. Marion Island (Goldstein); Heard Island (Busk).

Busk's figure gives a false impression of a semicircular orifice. Actually his specimens show a short, oval, membranous opesia, as in Goldstein's figure, and I have no doubt of the synonymy of the two forms. The shading of the opesia in Goldstein's figure, leaving a central clear oval, is curious, but one zooecium in Busk's dry mounts had a similar appearance. On mounting this zooecium as a transparency it was seen that the appearance is due to an accumulation of detritus round the edges of the frontal membrane.

In general appearance this species suggests *Brettia*, and, as it shows all the features of the genotype as enumerated by Harmer (1926, p. 198), I propose to place it in that genus for the present (see p. 477).

The zooecia are uniserial and may give rise to a single median distal zooecium or to two asymmetrically placed zooecia one of which is nearly but not quite median and the other more lateral. In both these arrangements the parent zooecium is very little wider distally and has no "shoulders". In a third arrangement the zooecium has a suggestion of shoulders, like those of *B. triplex*, but each shoulder carries a symmetrically placed lateral distal zooecium and there is nothing in the median distal position.

There is an ancestrula on Busk's slide 99.7.1.3653. It is rather short but does not otherwise differ from the other zooecia in shape. It is separated by a constriction from the small disk by which it is attached to a foraminiferan.

2. Brettia triplex sp.n. Fig. 56 D.

Station distribution. Not represented in the Discovery collections.

Geographical distribution. Oates Land (Terra Nova, St. TN 194).

Holotype. St. TN 194.

Description. *Zoarium* uniserial, bifurcating, each zooecium giving rise to two asymmetrically placed distal zooecia, one median or very nearly so, the other lateral to it.

Zooecia elongate 1–3 mm. long, expanded distally, one shoulder giving rise to the lateral distal zooecium, the other carrying an avicularium (Fig. 56 D). A small proximal segment separated by a deep constriction.

Opesia triangular, acutely pointed proximally, a little less than half the length of the zooecium. Orifice distal.

Avicularium rigidly attached, erect, with beak directed away from axis of branch.

Ovicells unknown.

REMARKS. About forty zooecia of this species were found in a jar of mixed fragments of several species all in a very brittle state. In most instances one or other of the two distal zooecia has been broken off, but they have left signs of breakage which leave me with no doubt that the triple arrangement, in which each zooecium supports a median distal zooecium, a distal lateral zooecium and a distal lateral avicularium, is typical. This species differs from *Brettia inornata* in the presence of avicularia, in the longer opesia, in the more pronounced shoulders supporting the lateral distal zooecium and avicularium and in the formation of median distal buds. There can be little doubt that the two forms are congeneric, and I have put them provisionally into *Brettia*, although the avicularia of *B. triplex* may ultimately exclude them from that genus. More material of *B. triplex* is very desirable.

These two species show some resemblance to *Maplestonia simplex* MacGillivray (1885, p. 107, pl. i, figs. 2, 2*a*, 2*b* = *Brettia simplex* Levinsen, 1909, p. 113, pl. iv, fig. 9 *a*, *b*), but not to the genotype of *Maplestonia*, *M. cirrata* MacGillivray.

GEOGRAPHICAL DISTRIBUTION

This report deals with so small a proportion of the Antarctic Polyzoa that their distribution cannot profitably be compared with that of other groups. The facts of the distribution of the species and genera considered in the report may, however, be usefully summarized.

DISTRIBUTION OF THE SPECIES

The distribution of the Antarctic and sub-Antarctic species of the families dealt with is given in Table 3. The Antarctic and sub-Antarctic areas are taken as the region south of the subtropical convergence (see map, Fig. 59). The subtropical convergence curves northwards in the south-eastern Pacific and goes off this map. Gunther (1936, p. 236) found it along the 30–32° S parallels in 95–105° W; and in 70–71° W, nearer the Chilean coast, it was as far north as 24–26° S. Thus Juan Fernandez and Valparaiso come within the sub-Antarctic area hydrologically. This is in keeping with the relationship between the faunas of Juan Fernandez and the Magellanic region discussed by Marcus (1921*a*, pp. 93–5).

In Table 3 the non-abyssal localities are grouped regionally as follows: (1) Australasian, (2) South Pacific, (3) South Atlantic Ocean, (4) South Indian Ocean, (5) Weddell Quadrant (plus Bouvet Island), (6) Victoria Quadrant. The localities are arranged from north to south except in the Victoria Quadrant where they are arranged from east to west. The abyssal stations, both Antarctic and sub-Antarctic, are all treated together in the last column. The South Pacific column includes Challenger St. 308 which is in 320 m. and is comparable with the stations off the Patagonian shelf (see p. 486). The order of the species is designed to group together those with similar distribution.

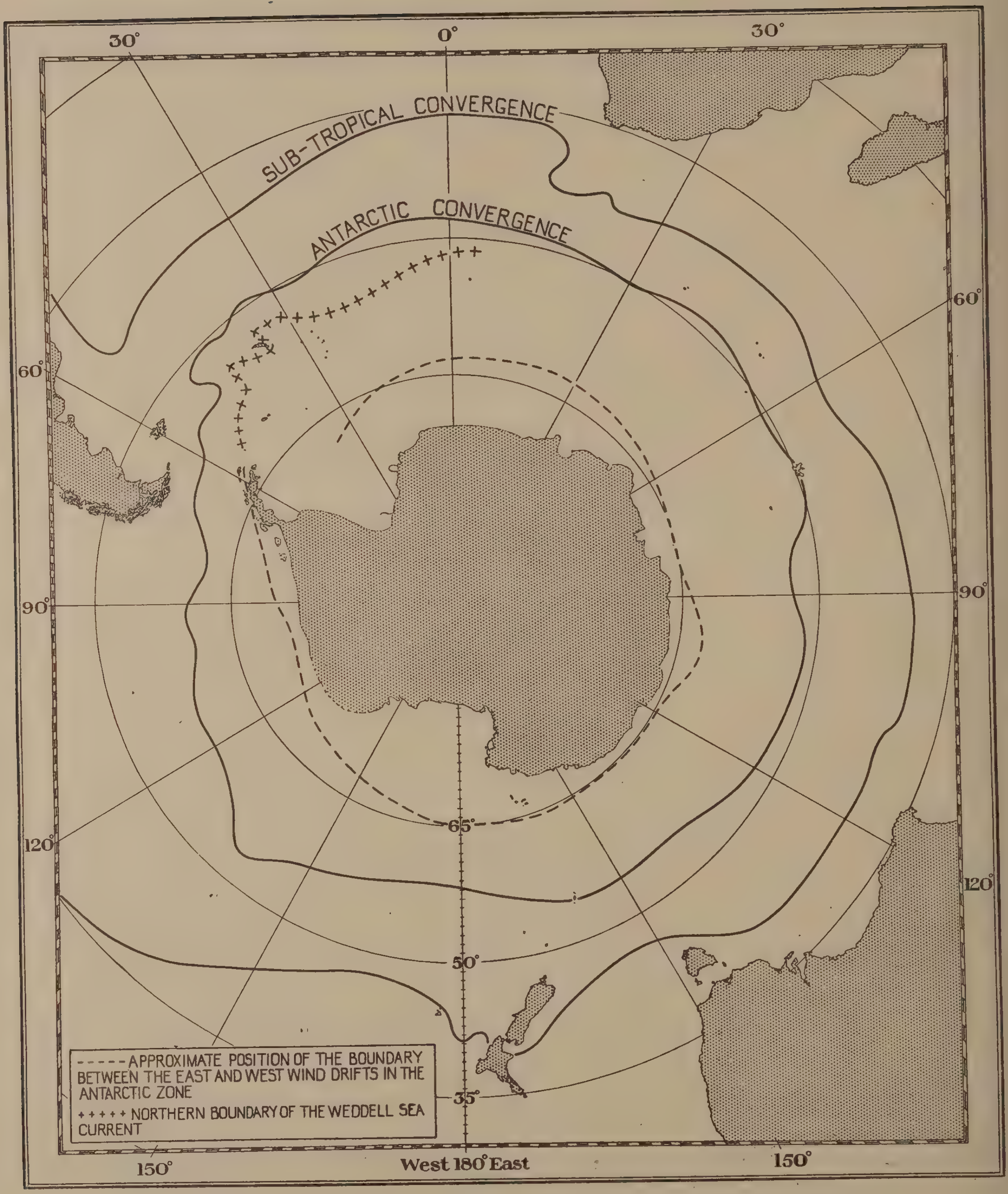
30°
0°
30°
SUB-TROPICAL CONVERGENCE
ANTARCTIC CONVERGENCE
60°
60°
90°
90°
120°
120°
65°
50°
35°
- - - - - APPROXIMATE POSITION OF THE BOUNDARY BETWEEN THE EAST AND WEST WIND DRIFTS IN THE ANTARCTIC ZONE
+ + + + + NORTHERN BOUNDARY OF THE WEDDELL SEA CURRENT
150°
West 180° East
150°

Fig. 59. Map of the south polar regions to show the Antarctic and subtropical convergences.

Table 3. *Distribution of the Antarctic and sub-Antarctic members of the Families considered in this Report*

	A	South of subtropical convergence																							
		Sub-Antarctic (non-abyssal)									B	Antarctic (non-abyssal)													
		Australasia	South Pacific Ocean	S. Atlantic Ocean					S. Indian Ocean				Weddell quadrant									Victoria quadrant			
	North of subtropical convergence	Auckland and Campbell Islands*	Chile and Juan Fernandez	Tristan da Cunha	Gough Island	Magellanic Region	Patagonian Shelf (including Falkland Islands)	Off Patagonian Shelf	Marion and Prince Edward Islands	Possession Island, Crozet Group	Kerguelen†	Heard Island	Shag Rocks	South Georgia	Bouvet Island	South Sandwich Islands	South Orkney Islands	Elephant Island	South Shetland Islands	Palmer Archipelago	Bellingshausen Sea (including Adelaide Island)	Ross Sea	Oates Land	Adelie Land	Wilhelm II Land and Queen Mary Land	Abyssal Stations (Antarctic and sub-Antarctic)
. (*rostrata* Marcus)	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ritina	+	+	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
strata	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
aria ornithorhyncus	+	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
uina	+	.	+	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
benemunita	.	.	+	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
tata var. *maxilla*	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
gilis	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
rmis var. *unicornis*	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
adesi	+	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
a	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
ambigua	+	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
la sp.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
vibraculifera	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
elongatus var. *cal-*	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
oum obtusum	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
tes atlanticus	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
crassimarginata	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
arwinii var. *guntheri*	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
na ovalis var. *versa*	.	.	.	.	.	.	.	+	.	.	?	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
gellanica	+	+	.	.	.	+	+	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
rmis	+	.	.	.	.	+	+	.	.	.	+	.	.	.	.	.	.	.	.	?	.	.	.	.	.	.
lagellifera	.	.	.	.	.	.	+	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
tata	.	.	.	.	.	+	+	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
nuda	.	.	.	.	.	+	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
kirkpatricki	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
empi	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
elongatus	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
uski	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
oum sinuosum	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	o
llum hexagonum	o‡	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
rnata	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
uadrata	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
allengeri	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
gissima	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	+	.	.	.	.

continued

ubtropical convergence. B. Antarctic convergence. o Abyssal records. + Non-abyssal records.

e sub-Antarctic portion of New Zealand has not been discriminated. All New Zealand records are represented as north of the subtropical ence.

Table 3 (*continued*).

	A	South of subtropical convergence																							
		Sub-Antarctic (non-abyssal)									B	Antarctic (non-abyssal)													
		Australasia	South Pacific Ocean	S. Atlantic Ocean					S. Indian Ocean				Weddell quadrant									Victoria quadrant			
	North of subtropical convergence	Auckland and Campbell Islands*	Chile and Juan Fernandez	Tristan da Cunha	Gough Island	Magellanic Region	Patagonian Shelf (including Falkland Islands	Off Patagonian Shelf	Marion and Prince Edward Islands	Possession Island, Crozet Group	Kerguelen†	Heard Island	Shag Rocks	South Georgia	Bouvet Island	South Sandwich Islands	South Orkney Islands	Elephant Island	South Shetland Islands	Palmer Archipelago	Bellinghausen Sea (including Adelaide Island)	Ross Sea	Oates Land	Adelie Land	Wilhelm II Land and Queen Mary Land
Camptoplites bicornis var. *quadriavicularis*	·	·	·	·	·	·	·	+	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·
Camptoplites asymmetricus	·	·	+	·	·	·	·	+	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·
Tricellaria aculeata	+	+	+	·	·	+	+	+	·	·	+	·	·	+	+	·	·	·	·	·	·	·	·	·	·
Menipea patagonica	·	·	·	·	·	+	+	·	·	·	+	·	·	+	+	·	·	·	·	·	·	·	·	·	·
Caberea darwinii	+	+	·	+	+	+	+	·	+	+	+	·	+	+	+	+	+	+	+	+	·	+	+	·	+
Cornucopina pectogemma	·	·	·	+	·	·	·	·	+	·	·	+	·	+	+	+	·	·	+	·	·	+	+	·	+
Amastigia gaussi	·	·	·	·	·	·	·	+	·	·	·	·	·	+	+	·	+	·	·	+	+	·	+	·	+
Notoplites crassiscutus	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	·	·	·
Camptoplites latus var. *aspera*	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·
Cornucopina ovalis	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	·	·	·	·	·
Camptoplites retiformis var. *tenuispina*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	+	·	·	·	·	·	·
Camptoplites latus var. *striata*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·
Beania erecta	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	+	·	·	·	·	+	+	·	·	·
Beania erecta var. *livingstonei*	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	+	+	+	·	+	·	+	·
Notoplites antarcticus	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·	·	·	+	·	+	+	·	+	·	+
Notoplites drygalskii	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	·	+	+	+	·	+	+	+	+
Notoplites tenuis	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	·	·	·	+	·	+	+	·	+
Farciminellum antarcticum	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	·	·	+	·	·	+	+	+	?
Himantozoum antarcticum	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	+	+	+	+	+	·	+	+	+	+
Camptoplites tricornis	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	·	·	+	+	+	+	+
Camptoplites bicornis var. *magna*	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	+	·	+	+	+	+	·	·	+
Camptoplites giganteus	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	·	+	·	·	+
Camptoplites retiformis	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	+	·	+	·	+	+	·	+
Cornucopina polymorpha	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	·	·	+	+	?	+	+	·	+
Notoplites klugei	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	·	·	+	·	·	+
Camptoplites angustus	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	+	?	+	+	·	+
Camptoplites bicornis var. *elatior*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	+	·	+	·	+
Erymophora klugei	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	?	·	+	·	+
Camptoplites areolatus	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	?	?	·	+	·	+
Camptoplites bicornis var. *compacta*	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	+	·	·	+
Notoplites vanhöffeni	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	+	+	·	+

continued

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† *Cellularia cirrata*, *Caberea boryi* and *Menipea benemunita* were included in Kirchenpauer's Kerguelen list (1889, p. 156) on the strength of Bu records which have proved to be based on *Menipea patagonica* (see p. 333), *Caberea darwinii* (see p. 374) and *Amastigia nuda* (see Harmer, 1923, p. 3

‡ The depth at which the specimen of *F. hexagonum* from the Andaman Islands was obtained is not recorded.

Table 3 (*continued*).

	A	South of subtropical convergence																								
		Sub-Antarctic (non-abyssal)								B	Antarctic (non-abyssal)															
		Australasia	South Pacific Ocean	S. Atlantic Ocean					S. Indian Ocean				Weddell quadrant									Victoria quadrant				
	North of subtropical convergence	Auckland and Campbell Islands*	Chile and Juan Fernandez	Tristan da Cunha	Gough Island	Magellanic Region	Patagonian Shelf (including Falkland Islands)	Off Patagonian Shelf	Marion and Prince Edward Islands	Possession Island, Crozet Group	Kerguelen†	Heard Island	Shag Rocks	South Georgia	Bouvet Island	South Sandwich Islands	South Orkney Islands	Elephant Island	South Shetland Islands	Palmer Archipelago	Bellinghausen Sea (including Adelaide Island)	Ross Sea	Oates Land	Adelie Land	Wilhelm II Land and Queen Mary Land	Abyssal Stations (Antarctic and sub-Antarctic)
watersi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	+	.
tes rectilinearis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.
tenuis var. *uni-*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.
tti	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
plex	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
antarctica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.
chinata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.
tes lewaldi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.
tes latus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.
cabereoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.
solida	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.
na lata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.
pateriformis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○
seriata	○	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○
s pocillum	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○
na infundibulata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○
na conica	○	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○
tes lunatus	○	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○
tes reticulatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○
tes bicornis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○
la magna	○	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○
oum sinuosum var. *is*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○
perditus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○
lum lineare	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○
tes abyssicolus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○
na rotundata	○	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○
na angulata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○
abyssicola	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○
sp.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	○

A. Subtropical convergence. B. Antarctic convergence. ○ Abyssal records. + Non-abyssal records.

* (See p. 479.) † (See p. 480.)

The thick line A represents the subtropical convergence. The entries to the left of this line indicate which species extend beyond the areas under consideration, and it is noticeable that the species with this wider distribution are a small minority. The details of their distribution, which in some is extensive, are to be found in the systematic part of this report.

The thick line B between the Falkland Islands and Heard Island marks the Antarctic convergence, all localities between lines A and B being between the two convergences and hydrologically sub-Antarctic, those to the right of line B south of the Antarctic convergence and hydrologically Antarctic.

The definition of the Antarctic and sub-Antarctic areas by means of the Antarctic and subtropical convergences gives them rather different limits from those accepted before the detailed work of the 'Discovery' (Deacon, 1933, 1937) was available. Hasenbank (1932, p. 323), for instance, regarded both Bouvet Island and Amsterdam Island (Neu Amsterdam) as sub-Antarctic, but Bouvet Island is south of the sub-Antarctic convergence and Amsterdam Island north of the subtropical convergence. The Antarctic affinities of the Bouvet Island Polyzoa appear from Hasenbank's own remarks. From Amsterdam Island he had *Scruparia ambigua* (recorded as *S. chelata*) which is known from the sub-Antarctic but is widely distributed in more northerly waters; and *Bugula dentata*, a widely distributed tropical and subtropical species (see p. 429).

The division between the Antarctic and sub-Antarctic regions is the most conspicuous feature of Table 3, the great majority of the species being found in one region or the other, but not in both. Only two of the few species common to the Antarctic and sub-Antarctic are widely distributed in both areas. The variation of *Caberea darwinii* in correlation with its distribution is described on p. 382. In *Cornucopina pectogemma*, which is less widely distributed in the sub-Antarctic regions, variation is less marked, and does not seem to be correlated with distribution. Among the remainder there are three Antarctic species that are only found, when north of the convergence, in the deeper water off the Patagonian Shelf (see p. 486), and four species known from South Indian islands on both sides of the convergence (see p. 483), one of which (*Bugula longissima*) reaches Ross Sea.

The fact that varieties are treated independently in the table does not seriously exaggerate the separation of the Antarctic and sub-Antarctic forms, for in only one instance (*Cornucopina ovalis*) are the typical form and the variety restricted to opposite sides of the convergence.

As the Antarctic convergence is a phenomenon of the surface waters, it is, at first sight, surprising that the distribution of bottom-living forms such as Polyzoa, should be so closely correlated with it. It must, however, be remembered that the Antarctic surface layer (Deacon, 1933, p. 173) is of considerable depth, and that the great majority of the Polyzoa have been taken in relatively shallow water, and would be subject to "surface" conditions. It has, moreover, been shown by Deacon (1937, pp. 3, 24) that the position of the convergence at the surface is determined by conditions in the deeper waters. His diagrams (1937, fig. 1, p. 4; fig. 5, p. 22) of the vertical circulation of the water in the South Atlantic Ocean and of the temperatures at 2000–2500 m. throughout the area show that the Antarctic convergence corresponds to a marked change in conditions at all depths (cf. discussion of abyssal species, p. 484).

The Antarctic and sub-Antarctic abyssal records (right-hand column) are all from depths of more than 2000 m. A few of the records of these species outside the area (left-hand column) are from depths between 1000 m. and 2000 m. (see Table 3 A), and are thus not truly abyssal. They appear, however, to be part of a deep-water fauna best represented by the abyssal symbol.[1] Only four of the abyssal species extend into depths of less than 1000 m. and two of these are only known from deep water. The four species are *Farciminellum hexagonum*, known from Marion Island in the sub-Antarctic region and abyssally farther north; *Himantozoum sinuosum*, known from the islands of the south Indian Ocean and abyssally in the Antarctic; *Kinetoskias pocillum*, known abyssally off Valparaiso and in less than 733 m. off Brazil; and *Cornucopina conica*, known abyssally off the Crozet Islands and from the Malay Archipelago both abyssally and in 924 m. (see Table 3 A).

Within the sub-Antarctic area the few species known from the South Pacific region are, with the possible exception of the unnamed *Caberea* (see p. 390), also known from the South Atlantic region. The South Atlantic and South Indian regions have some species in common, but most are restricted to one or other of the two regions. Here, too, the tabulation of varieties and species independently makes little difference, *Notoplites elongatus* being the only instance where the species is in one zone and the variety in the other.

The islands of the South Indian Ocean are on the border-line hydrologically (see Deacon, 1933, p. 193). Marion Island, Prince Edward Island and the Crozet group are to the north of the Antarctic convergence, which passes through Kerguelen and leaves Heard Island well to the south. Hydrographic conditions in the region are complicated (see Deacon, 1937, pp. 31, 34, 35), but Heard Island is clearly Antarctic hydrologically.[2] Nevertheless, the Polyzoan fauna of Heard Island appears to be related to that of the other islands of the group. The Cellularine Polyzoa of the whole group of islands comprise (1) species not known elsewhere (except *Farciminellum hexagonum* found abyssally further north), (2) species also found in South Atlantic sub-Antarctic localities, (3) species common to the Antarctic and the South Atlantic or South Pacific regions of the sub-Antarctic, (4) species found in the Antarctic but not in the South Atlantic or South Pacific regions of the sub-Antarctic. Half the species are not known elsewhere (group 1). Of the remainder the majority are sub-Antarctic species unknown in the Antarctic (group 2), while group 4 only comprises two species, *Himantozoum sinuosum*, known abyssally in the Antarctic, and *Bugula longissima*. Moreover, the most characteristically Antarctic genus in this report, namely *Camptoplites* (see p. 492), has not been recorded from these islands except at an abyssal station. There are thus some grounds for regarding the Cellularine Polyzoa of the islands of the South Indian Ocean as sub-Antarctic rather than Antarctic.

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[1] A few of the non-abyssal species extend into depths of a little more than 1000 m., but such records have not been discriminated.

[2] The data published by Howard (1940, p. 43) afford further evidence of the Antarctic character of Heard Island. Forthcoming Discovery Station Lists will give hydrological data for more stations in this region.

It has seemed best to count Tristan da Cunha as sub-Antarctic, for the purposes of Table 3, although Deacon (1937, p. 59) shows that the subtropical convergence sometimes runs to the north and sometimes to the south of the island, which is thus not fully sub-Antarctic. Of the five species from Tristan in this report, two, *Caberea darwinii* and *Cornucopina pectogemma*, are real Antarctic-sub-Antarctic species; two, *Scrupocellaria ornithorhyncus* and *Aetea anguina*, are found at various sub-Antarctic localities, but also extend more or less widely north of the area; and one, *Caberea rostrata*, is known from New Zealand.

In the Antarctic area the Weddell and Victoria Quadrants are on opposite sides of the Antarctic continent, and nearly half the species have only been found at one side or the other.

Table 3 A shows the distribution of the abyssal species known from the Antarctic and sub-Antarctic areas (o in Table 3). The heavy lines A and B again represent the subtropical and Antarctic convergences respectively. Species from both sides of the Antarctic convergence have been recorded at localities north of the subtropical convergence, but there are only two species, *Himantozoum sinuosum* and *Cornucopina infundibulata*, that are known from both the Antarctic and the sub-Antarctic areas.

The three zones separated by the convergences have been subdivided geographically so that the table comprises eight sections. Considering the nine species that have been recorded from more than one of these sections, one notices, in the first place, that the more northerly records of the sub-Antarctic South Indian Ocean species are from the geographically adjacent Malay Archipelago, but that the species south of the Antarctic convergence have been found in the Atlantic Ocean or the northern part of the Indian Ocean, both of which are separated from the Antarctic localities by areas in which the species have not been found.

Deacon (1937, fig. 1) gives a diagram of the meridional circulation in the Atlantic Ocean, and has found a very similar circulation throughout the Southern Ocean (1937, pp. 3 etc. and figs. 5, 8).

Comparing Table 3 A with Deacon's diagram it appears that two of the Atlantic stations at which the Antarctic species were found, being below 4000 m. in the region north of the subtropical convergence, may well have been under the influence of the Antarctic bottom current and therefore comparable hydrologically to the Antarctic abyssal stations. (The third station was in only 3477 m.) Similarly the South Indian Ocean station with Malayan species was at 2938 m. in the region between the two convergences and was probably in the warm deep layer (see Deacon, 1937, pp. 3, 81). The Pacific station off Valparaiso is just south of the subtropical convergence in 3953 m., and may also have been in the warm deep layer. Its species are known from Malayan and South Indian localities, like the last group, and also from a relatively shallow station off Brazil, for which I have no hydrological data. The only marked discrepancy is the two Antarctic forms found off East Africa.

Table 3 A. Distribution of the Cellularine Polyzoa known from abyssal stations within the Antarctic and sub-Antarctic areas

A B

	Off Brazil	South Atlantic Ocean			Off East Africa	Malay Archipelago				Off Valparaiso	South Indian Ocean				Victoria quadrant				Weddell quadrant
	Challenger, St. 122, 58·6–732 m.	Challenger, St. 323, 3477 m.	St. 325, 4850 m.	St. 332, 4026 m.	Valdivia, St. 250, 1668 m.	Siboga, St. 170, 924 m.	St. 211, 1158 m.	St. 295, 2050 m.	Challenger, St. 196, 1509 m.	Challenger, St. 299, 3953 m.	Challenger, Prince Edward Island, 146–275 m.	Kerguelen, depth?	St. 146, 2516 m.	St. 147, 2938 m.	Challenger, St. 157, 3568 m.	St. 156, 3614 m.	St. 153, 3065 m.	Gauss, 2450–3423 m.	Belgica, 2800 m.
Bottom temperature (Centigrade)	?	+0·6°	+0·4°	+1·1°	+3·8°	?	?	?	+2·7°	+1·8°	?	?	+2·0°	+1·2°	+0·6°	−0·4°	+0·1°	?	+0·5°
Tricellaria sp.	.	.	.	.	.	.	.	.	.	o	.	.	.	.	.	.	.	.	.
Amastigia pateriformis	.	.	.	.	.	.	.	.	.	o	.	.	.	.	.	.	.	.	.
Kenella biseriata	.	.	.	.	.	.	.	.	o	o	.	.	.	.	.	.	.	.	.
Kinetoskias pocillum	+	.	.	.	.	.	.	.	.	o	.	.	.	.	.	.	.	.	.
Camptoplites reticulatus	.	.	.	.	.	.	.	.	.	o	.	.	.	o	.	.	.	.	.
Cornucopina conica	.	.	.	.	.	+	o	.	.	.	.	.	.	o	.	.	.	.	.
Camptoplites lunatus	.	.	.	.	.	.	.	o	.	.	.	.	.	o	.	.	.	.	.
Cornucopina infundibulata	.	.	.	.	.	.	.	.	.	.	.	.	o	o	.	o	.	.	.
Himantozoum sinuosum[1]	.	.	.	.	o	.	.	.	.	.	+	+	.	.	.	.	.	o	.
Camptoplites bicornis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	o	.	.	.	.
Levinsenella magna	.	o	o	.	o	.	.	.	.	.	.	.	.	.	.	.	o	o	.
Himantozoum sinuosum var. *variabilis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	o	.
Notoplites perditus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	o	.
Farciminellum lineare	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	o	.
Camptoplites abyssicolus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	o	.
Cornucopina rotundata	.	.	.	o	.	.	.	.	.	.	.	.	.	.	.	.	.	o	.
Cornucopina angulata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	o	.
Amastigia abyssicola	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	o	o

[1] The entries under *Himantozoum sinuosum* comprise two forms and it is uncertain whether they should be treated as distinct (see p. 425). One was obtained from Valdivia St. 250, the other from the shallow south Indian Ocean Stations, and both appear to have been obtained abyssally in the Southern Ocean by the 'Gauss'.

Records in depths of less than 1000 m. are represented by a cross (+), records in more than 1000 m. by a circle (o).

As an indication of the actual hydrological conditions I have noted the bottom temperatures where known.[1] Much information on the general circulation is to be found in Deacon's report (1937). In particular his section 9 (pls. xvi–xviii), which runs from the Antarctic to Australia across the South Indian Ocean, is instructive in this connexion. His sections afford ample evidence that in the relatively shallow parts of the oceans the bottom fauna may be immersed in a water-layer which in deeper parts is an intermediate layer.

It thus seems possible, though the evidence is insufficient and not conclusive, that the apparent discontinuities in the distribution of these abyssal forms are significant in that they may represent a real absence of the species under certain hydrological conditions; but are fortuitous in that the depths of the stations examined have happened to be such that all the specimens from the same geographical region have come from the same hydrological conditions. It seems possible for example that stations in deeper parts of the sub-Antarctic (say in the South Indian Ocean) might yield samples of the fauna of the Antarctic bottom water, thus filling the geographical gap between the Antarctic and Atlantic records of these species. This would also show that, as might be expected, the change in the abyssal fauna at the Antarctic convergence is less simple than it appears to be in Table 3 A.

Thus, although no conclusions can be drawn from the very scanty faunal data at present available, there appear to be distinct indications that interesting results may be obtained when further collecting can be done in the abyssal regions.

Table 4 shows the distribution, in relation to depth, of the species from the Patagonian and Magellanic regions, the stations being arranged in order of mean depth. The species form three groups: (I) shallow-water species, not found below 118 m.; (II) species found at all depths; (III) species only found below 200 m. As the deepest station is at only 415 m., group III does not represent an abyssal fauna, or anything approaching it, but it does comprise species that have not been found on the continental shelf, which is at about 180 m. Fig. 60 shows the distribution of these stations in relation to the 200 m. line.

It is striking that, with two exceptions, the species restricted to the deeper water are new species and varieties. Of the two known forms, *Amastigia crassimarginata* has not been recorded elsewhere, and has no obviously near relative; *A. gaussi* is otherwise restricted to Antarctic waters; and three of the other four species in group III and the last two species in group II appear to have Antarctic affinities as the following analysis able 4. *Distribution according to depth of the Cellularine Polyzoa collected during the Discovery Investigations in the Magellanic and Patagonian regions, including the Falkland Islands*

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[1] I have been unable to ascertain the bottom temperatures at the Siboga stations, but the Snellius Expedition took temperatures in the same region (Riel, 1934). These were published in the form of potential temperatures in which allowance was made for compression (Riel, 1934, p. 11). The following Snellius sections give some idea of probable conditions at two of the Siboga stations:

Section 21, Riel, p. 43 (for Siboga St. 211, south of Celebes), potential temperature at 1100 m. a little above 4·0° C.

Section 25 (Indian Ocean end), Riel, p. 47 (for Siboga St. 295, south of West Timor), potential temperature at 2000 m. about 2·35° C.

Section 28, Riel, p. 51, passes through the region of Siboga St. 170, between New Guinea and Ceram, but the temperatures are only given from 1200 m. downwards.

e stations are shown on the map (text-fig. 60). Challenger St. 320, which is also included, is off the map to the north-east in 37° 17′ S, 53° 52′ W.

		I. Shallow water fauna												II. Species with a wide depth distribution								III. Species only found off continental shelf						
Mean depth in metres	Station	*Scrupocellaria ornithorhyncus*	*Aetea anguina*	*Amastigia vibraculifera*	*Beania fragilis*	*Beania costata* var. *maxilla*	*Beania inermis* var. *unicornis*	*Bicellariella* sp.	*Scruparia ambigua*	*Beania costata*	*Amastigia nuda*	*Menipea patagonica*	*Beania inermis*	*Tricellaria aculeata*	*Beania magellanica*	*Caberea darwinii*	*Amastigia benemunita*	*Menipea flagellifera*	*Notoplites elongatus* var. *calveti*	*Himantozoum obtusum*	*Camptoplites atlanticus*	*Cornucopina ovalis* var. *versa*	*Amastigia gaussi*	*Caberea darwinii* var. *guntheri*	*Camptoplites bicornis* var. *quadriavicularis*	*Camptoplites asymmetricus*	*Amastigia crassimarginata*	
1	53	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	
1½	58	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	
2½	724	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	
13	56	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	
27	1230	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	
32½	222	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
45	1902	.	+	.	.	.	.	.	+	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	
53½	WS 847	.	+	.	.	.	.	.	+	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	
64	WS 836	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	
66	1321	+	.	.	.	.	+	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	
74½	WS 84	.	+	+	+	.	+	.	.	.	+	+	.	+	+	+	+	+	+	.	.	.	.	.	.	.	.	
77	WS 755	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	
79	WS 85	.	.	+	+	+	+	.	.	.	+	.	+	+	+	+	+	+	+	+	.	.	.	.	.	.	.	
81½	WS 81	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	
83½	WS 221	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	
95	WS 72	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	
103	WS 776	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	
103	WS 222	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	
106½	WS 220	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	
108½	WS 95	.	.	.	.	.	.	.	+	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	
110	48	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	
110	51	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	+	.	.	.	.	.	.	.	.	
111	WS 87	.	.	.	.	.	.	.	.	.	+	+	.	+	.	+	+	+	.	.	.	.	.	.	.	.	.	
115½	WS 765	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	
118	WS 88	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	+	+	.	.	.	.	.	.	.	.	L
121	388	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	
124½	WS 794	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	
125½	WS 73	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	
131½	WS 93	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	+	.	.	.	.	.	.	
131½	WS 79	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	+	.	.	.	.	.	.	.	.	
132	1909	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	
133	WS 83	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	
139½	WS 825	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	
141½	WS 824	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.	.	.	
142	WS 82	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	
142½	WS 243	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	+	.	.	.	.	.	.	.	.	
148	WS 781	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	
149	WS 86	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	
153½	WS 838	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	+	.	.	.	.	.	.	.	.	.	
154	WS 80	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	
155	WS 783	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	
161½	WS 225	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	+	+	.	.	.	.	.	.	.	
163	WS 231	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	+	.	+	+	.	.	.	.	.	.	
166	WS 249	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	
167	WS 784	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	
170	652	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	
172	WS 247	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	S
194½	WS 239	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	
203	WS 237	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	+	+	.	.	.	.	.	.	.	.	
206	WS 76	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	
232½	WS 228	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	?*	.	.	.	.	.	
237½	WS 246	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	+	.	?	.	.	.	.	.	
240½	WS 229	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	?	.	.	.	.	.	
250	WS 244	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	+	.	.	.	.	.	.	.	.	
293½	WS 773	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	
315	WS 245	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	+	.	.	.	+	.	.	.	.	
338½	WS 871	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	+	.	+	.	+	+	.	.	
415½	WS 840	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	+	+	
098	Chall. 320	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	+	+	

L. Lower limit of shallow water fauna. S. Approximate level of continental shelf.

* The three doubtful specimens of *Cornucopina ovalis* var. *versa* were without avicularia, see p. 404.

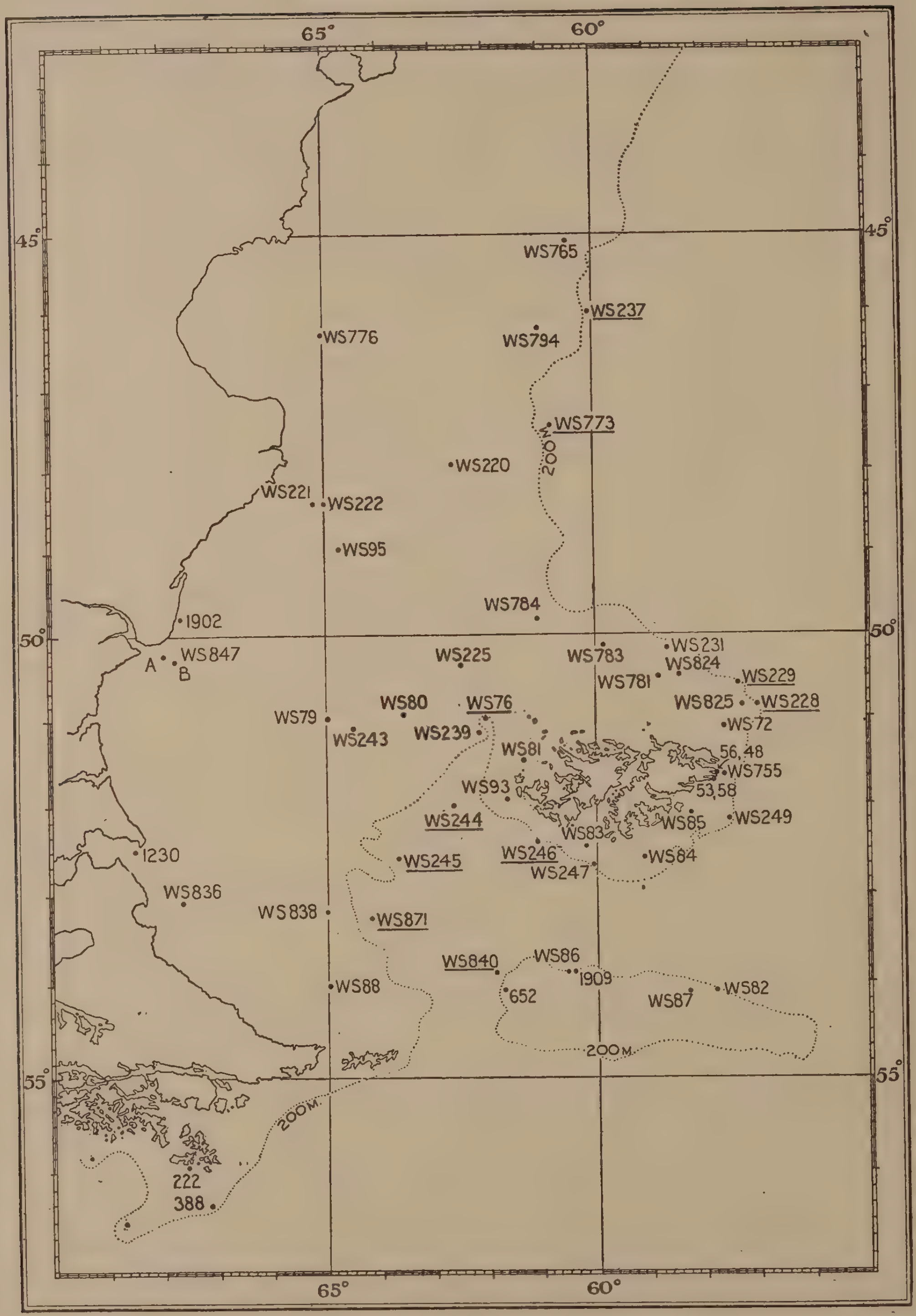
65°
60°
45°
50°
55°
WS765
WS237
WS776
WS794
WS773
200 M.
WS220
WS221
WS222
WS95
WS784
1902
WS847
A
B
WS225
WS783
WS231
WS824
WS781
WS229
WS825
WS228
WS80
WS76
WS79
WS243
WS239
WS72
WS81
56, 48
WS755
WS93
53, 58
WS244
WS85
WS249
WS83
1230
WS245
WS246
WS247
WS84
WS836
WS838
WS871
WS840
WS86
1909
652
WS88
WS87
WS82
200 M.
200 M.
222
388

Fig. 60. Map of the Patagonian and Magellanic Regions showing the positions of the stations listed in Table 4. The 200 m. line is approximate but is correct in relation to the stations. Stations below 200 m. are underlined.

shows. The presence of three species of the typically Antarctic genus *Camptoplites* (see p. 492) is in itself significant.

Camptoplites bicornis var. *quadriavicularis* is also found at the Shag Rocks, near South Georgia which has a predominantly Antarctic Polyzoan fauna (see below). The three other varieties of *C. bicornis* are Antarctic, and the typical form came from an abyssal station in the Antarctic region.

C. asymmetricus is also found at South Georgia, and in the deeper water on the Chilean coast (see below). Its nearest relative, *C. areolatus*, is Antarctic.

Caberea darwinii var. *guntheri* is not known elsewhere, but resembles the Antarctic form of *C. darwinii*, in contrast to the shallow-water Falkland specimens which represent the extreme sub-Antarctic type of the species (see p. 386).

Cornucopina ovalis var. *versa*, on the other hand, shows definite affinities outside the Antarctic, for, although the typical form is found at South Georgia, their nearest relative appears to be the Victorian *C. grandis*. The variety is known from Kerguelen where it was found in 36½ m. and may perhaps have been found in the Straits of Magellan (see p. 403).

Camptoplites atlanticus and *Himantozoum obtusum*, both of which extend into rather more shallow Falkland waters, are not found elsewhere, but they, too, are related to Antarctic species, *Camptoplites latus* and *Himantozoum antarcticum* respectively.

Notoplites elongatus var. *calveti* comes next to these forms in order of depth and extends into shallow water. The typical form is known from Kerguelen and Marion Island where it forms part of a fauna with sub-Antarctic rather than Antarctic affinities (see p. 484).

There is some evidence that the bottom water off the Patagonian Shelf may in part be of Antarctic origin and character. A branch of the current of Antarctic surface water from the Bellingshausen Sea is known to turn north towards the Falkland Islands and, having sunk below the sub-Antarctic surface water at the Antarctic convergence, to travel north, mixing with the lower layers of the Falkland current, which is a northward current of sub-Antarctic surface water along the coast of Patagonia. (Information obtained, about 1936, through Mr Clowes, from Dr Deacon's unpublished results. Also see Deacon, 1937, pp. 32, 33, 51.)

On the other hand, one of the species with Antarctic affinities (*Camptoplites asymmetricus*) was also found on the Chilean coast where there is not such a strong northward flow of Antarctic water. The specimen was obtained in 320 m. in one of the channels between the islands and the mainland (Challenger St. 308). I am indebted to Dr Deacon for information about the hydrological conditions in this region.

Table 5 shows the species from South Georgia similarly tabulated in relation to depth. It is less complete than Table 4, being based on little more than half the number of stations, and, although there are very nearly as many stations from 190 m. downwards, the 300–400 m. zone is untouched, so that a fair comparison can hardly be made. To emphasize the Antarctic nature of the South Georgian fauna as a whole, Antarctic species are marked A, and those whose nearest relative is Antarctic are marked A*. The exclusively shallow-water fauna comprises a single species, *Menipea patagonica*, which is chiefly found in the sub-Antarctic.

Table 5. *Distribution according to depth of the Cellularine Polyzoa collected during the Discovery Investigations at South Georgia and the Shag Rocks*

Mean depth in metres	Station	*Menipea patagonica*	*Caberea darwinii*	*Notoplites drygalskii*	*Himantozoum antarcticum*	*Amastigia gaussi*	*Camptoplites retiformis*	*Camptoplites tricornis*	*Cornucopina polymorpha*	*Cornucopina pectogemma*	*Beania erecta* var. *livingstonei*	*Farciminellum antarcticum*	*Camptoplites latus* var. *aspera*	*Camptoplites giganteus*	*Notoplites antarcticus*	*Notoplites crassiscutus*	*Beania erecta*	*Cornucopina ovalis*	*Camptoplites bicornis* var. *quadriavicularis*	*Notoplites tenuis*	*Camptoplites bicornis* var. *magna*	*Camptoplites asymmetricus*
			A	A	A	A	A	A	A	A	A	A	A*	A	A		A		A*	A	A	A*
2	WS 56	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
11	MS 64	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
22½	WS 25	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
30½	145	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
39	MS 65	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
48½	WS 177	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
85	MS 71	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
106	153	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
107	WS 27	.	+	+	+	.	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.
110	27	.	.	+	+	+	+	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.
129	140	.	+	+	.	+	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.
130	WS 33	.	+	+	+	.	+	+	+	+	.	.	.	+	.	.	.	.	.	.	.	.
140	148	.	+	+	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.
150	MS 14	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
160	159	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.
162	42	.	+	+	+	+	+	+	.	+	+	+	.	.	+	+	.	.	.	.	.	.
166½	144	.	.	+	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
177	160	.	+	.	.	.	.	+	.	.	.	.	.	.	+	+	+	+	+	.	.	.
S																						S
198	WS 42	.	+	.	+	+	+	+	.	+	.	+	+	.	+	.	.	.	.	.	.	.
199	474	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
200	20	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
207	39	.	.	.	.	+	+	.	.	.	.	.	.	.	+	.	.	.	.	+	+	.
217	149	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
218	156	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+
233½	MS 68	.	.	.	.	.	.	+	.		.	.	.	.	.	.	.	.	.	.	.	.
240	123	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
245	152	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
254	45	.	+	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.
406	148	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.

A. Species and varieties also known from within the Antarctic circle.
A*. Species and varieties whose nearest relative is found within the Antarctic circle.
S. Approximate level of continental shelf.

The collections also comprised material from localities outside the Antarctic and sub-Antarctic areas, as follows:

- Cape Verde Islands
  - *Bugula dentata*
- Ascension Island
  - *Aetea curta*
  - *Scrupocellaria frondis*
- South Africa
  - *Menipea crispa*
  - *M. triseriata*
  - *Bugula calathus*
- Queenscliffe Jetty, Port Phillip, Victoria
  - *Scrupocellaria ornithorhyncus*
  - *Scruparia ambigua*
  - *Aetea anguina*
- New Zealand
  - *Amastigia harmeri*
  - *Menipea zelandica*
  - *M. vectifera*
  - *Tricellaria monotrypa*
  - *Emma triangula*
- New Zealand (*cont.*)
  - *Scrupocellaria ornithorhyncus*
  - *Canda arachnoides*
  - *Caberea boryi*
  - *C. helicina*
  - *C. darwinii* (*minima*-type)
  - *C. glabra*
  - *C. angusta*
  - *C. rostrata*
  - *Synnotum aegyptiacum*
  - *Cornucopina zelandica*
  - *C. moluccensis*[1]
  - *Beania discodermiae*[1]
  - *B. pulchella*
  - *B. intermedia*[1]
  - *Bugula expansa* Hastings (1939, p. 338)[1]
  - *B. cucullata* var. *cuspidata*
  - *Caulibugula tuberosa*
  - *Dimetopia cornuta* Busk (1852*a*, p. 384)[1]
  - *Scruparia ambigua*

Some of these species are also known from the sub-Antarctic region, namely, *Aetea curta*, *Scrupocellaria ornithorhyncus*, *Caberea darwinii*, *C. rostrata* and *Scruparia ambigua* (see Table 3, p. 479).

THE RELATION BETWEEN HYDROLOGICAL CONDITIONS AND THE DISTRIBUTION OF THE SPECIES

The outstanding feature of the foregoing discussion is the correlation of the distribution of the species with hydrology. The abundant collections of specimens, and the fine and comprehensive analysis of the hydrology provided by the Discovery Investigations give an unusual opportunity of testing this relationship. My results are, for reasons explained on p. 477, incomplete and tentative, but I think they are very suggestive.

Among the Antarctic and sub-Antarctic Cellularine Polyzoa we have several instances of apparent correlation:

(1) The decisive influence on the non-abyssal fauna of the change in hydrological conditions at the Antarctic convergence which is demonstrated by Table 3 (p. 479).

(2) The presence of a fauna with Antarctic affinities in a zone off the Patagonian shelf probably influenced by Antarctic water, demonstrated in Table 4 (p. 487).

(3) The possible relation of the distribution of the abyssal species to the warm and cold deep currents (p. 486).

On the other hand, the fauna of Heard Island is similar to that of the other islands in the South Indian Ocean despite its different hydrological conditions (see p. 483).

In the distribution of plankton the very close correlation with hydrological conditions is well known, and, among free-swimming animals, the distribution of the fishes has been found to correspond very closely with the temperature of the water (Norman, 1931,

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[1] Collected by the Terra Nova Expedition, not obtained by the 'Discovery'. For those not discussed elsewhere in this report a reference is given.

p. 255). The restriction of bottom-living animals to particular habitats in more or less limited regions has been shown by various ecological surveys; but I think the possibility of a close correlation with hydrology of the wider geographical distribution of a group, whose members are not only bottom-living but fixed, has not been generally recognized. Detailed analysis of this relationship might explain some of the apparent anomalies of distribution.

DISTRIBUTION OF THE GENERA

From Table 3 (p. 479) we see that fourteen genera of Cellularine Polyzoa are represented in the hydrologically Antarctic region south of the Antarctic convergence.

Two of these (*Tricellaria* and *Menipea*) are represented by only two species, and only penetrate the northern part of the Antarctic area. *Bugula*, which otherwise has an almost world-wide distribution, is represented in the Antarctic area by a single rather aberrant species, *B. longissima*. The genus is also almost completely absent from sub-Antarctic waters, *B. hyadesi* being the only species recorded.

Consideration of the distribution of *Brettia* and the two new genera, *Klugella* and *Erymophora*, must wait till further revision of other faunas gives us a reliable list of the species to be included.

This leaves eight Antarctic genera whose distribution can profitably be discussed. Six of these, *Amastigia*, *Notoplites*, *Farciminellum*, *Cornucopina*, *Himantozoum* and *Camptoplites*, are predominantly Antarctic and sub-Antarctic. The other two, *Beania* and *Caberea*, are distributed almost throughout the world. *Beania* has several sub-Antarctic species, and two Antarctic ones, namely, *B. erecta*, which is common, and *B. scotti*, known from a single fragment. *Caberea* is represented in our area by a single, widely distributed, variable species, *C. darwinii* (see p. 382), and by *C. rostrata* which is found at Tristan and New Zealand.

The distribution of the six predominantly Antarctic genera is summarized in the maps (Figs. 61–66). The numbers on the maps represent the number of species recorded from each locality. Species from depths greater than 1000 m. are indicated by figures on black circles. A list of the species that I have included in the genus is given with each map, with a reference to the page in the report where the distribution of each species is to be found. Where the distribution is not included in this report a reference is given.

In each genus we find at least one species that is very widely distributed in the Antarctic, at least one shallow-water sub-Antarctic form, and a few deep-water species extending farther north, particularly in the Atlantic and the Malay Archipelago. This completes the story of the distribution of *Camptoplites*,[1] but the other genera are more widely dispersed. *Notoplites*, which is found in deep water in the Atlantic, appears again in shallow boreal and Arctic waters, and *Amastigia* is known from South Africa; but only three[2] species in all the six genera are recorded in shallow water from America

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[1] See Addendum, p. 501.

[2] Including *Cornucopina antillea* Osburn from 732 m.

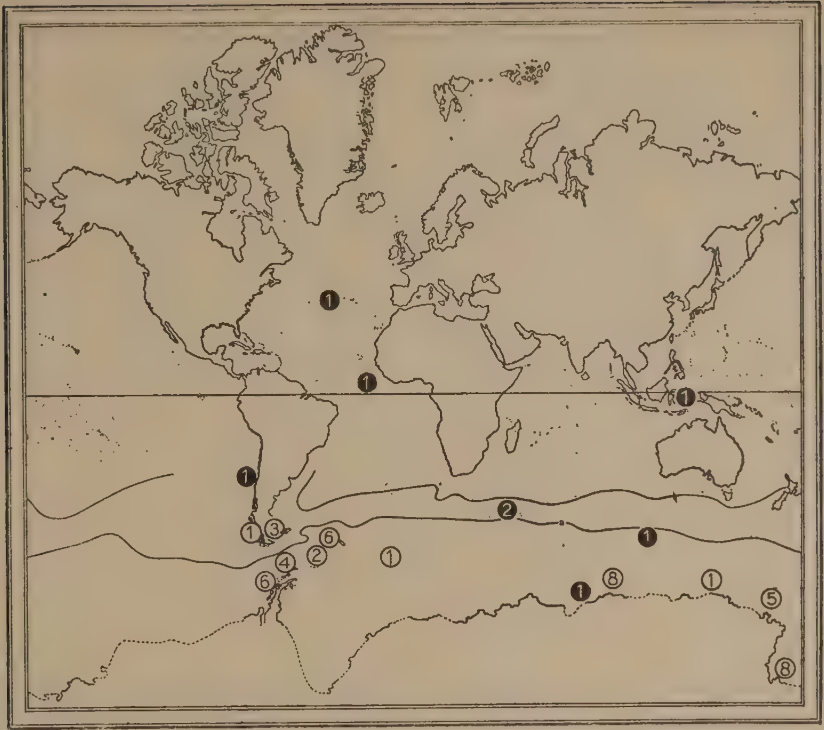

Fig. 61. Map to show the distribution of the genus *Camptoplites*, based on distribution of: *C. abyssicolus* (Kluge), p. 452; *C. angustus* (Kluge), p. 453; *C. areolatus* (Busk), p. 466; *C. asymmetricus* sp.n., p. 466; *C. atlanticus* sp.n., p. 460; *C. bicornis* (Busk) and vars., pp. 443–449; *C. giganteus* (Kluge), p. 451; *C. latus* (Kluge) and vars., p. 458; *C. lewaldi* (Kluge), p. 449; *C. lunatus* Harmer, p. 464; *C. rectilinearis* sp.n., p. 462; *C. reticulatus* (Busk) and var., p. 463; *C. retiformis* (Kluge) and var., pp. 453, 455; *C. tricornis* (Waters), p. 451.

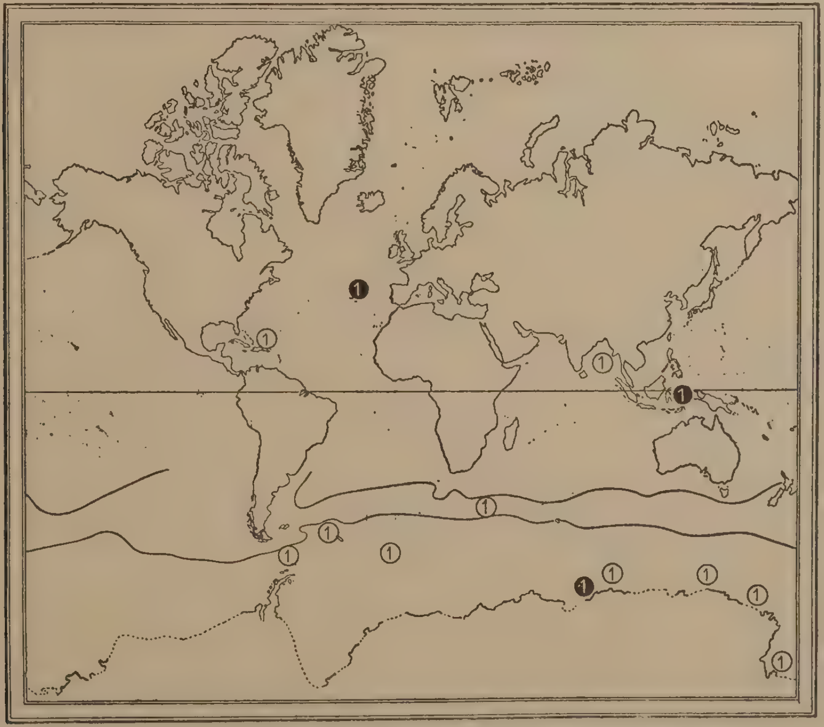

Fig. 62. Map to show the distribution of the genus *Farciminellum*, based on distribution of: *F. alice* (Jullien & Calvet), see Harmer, 1926, p. 405; *F. antarcticum* sp.n., p. 391; *F. atlanticum* (Busk), see Harmer, 1926, p. 405; *F. hexagonum* (Busk), p. 393; *F. lineare* (Kluge), p. 393. The depth at which *F. hexagonum* was obtained at the Andaman Islands is not recorded.

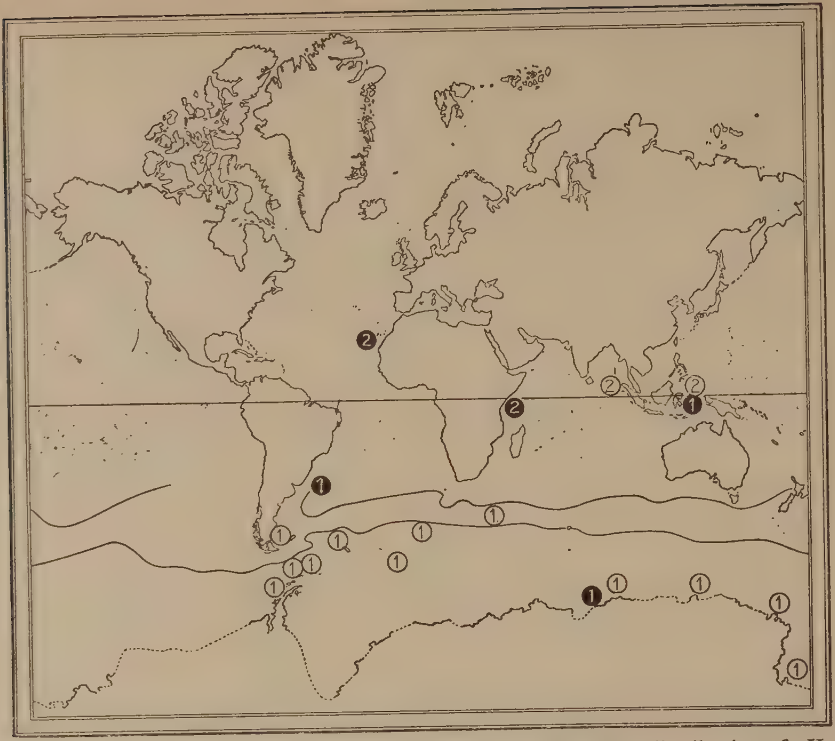

Fig. 63. Map to show the distribution of the genus *Himantozoum*, based on distribution of: *H. antarcticum* (Calvet), p. 422; *H. apsteini* (Hasenbank, 1932, p. 333); *H. emaciatum* Harmer, 1926, p. 455; *H. hessei* (Hasenbank, 1932, p. 331); *H. leontodon* (Busk) and var., see Hasenbank, 1932, p. 335; *H. margaritiferum* (Busk, 1884, p. 41); *H. mirabile* (Busk, 1884, p. 39); *H. obtusum* sp.n., p. 424; *H. sinuosum* (Busk) and var., pp. 425, 426; *H. taurinum* Harmer, 1926, p. 454.

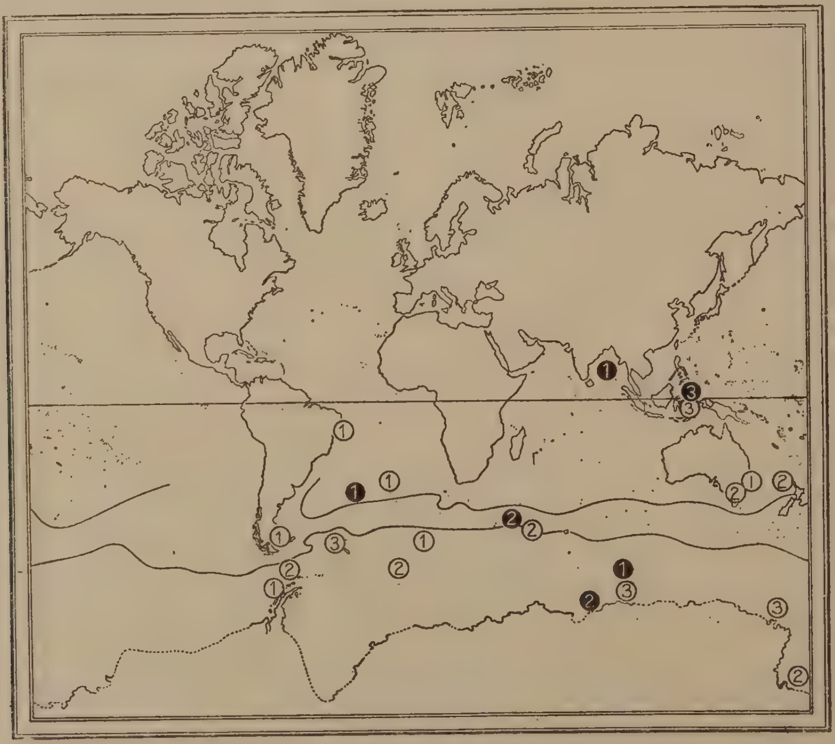

Fig. 64. Map to show the distribution of the genus *Cornucopina*, based on distribution of: *C. angulata* (Kluge), p. 406; *C. bella* (Busk); *C. conica* Harmer, p. 398; *C. geniculata* Harmer; *C. grandis* (Busk); *C. infundibulata* (Busk), p. 399; *C. lata* (Kluge), p. 402; *C. moluccensis* (Busk), p. 406; *C. navicularis* (Busk), p. 406; *C. ovalis* sp.n. and var., pp. 402, 404; *C. pectogemma* (Goldstein), p. 397; *C. polymorpha* (Kluge), p. 399; *C. rotundata* (Kluge), p. 407; *C. tuba* (Busk); *C. zelandica* sp.n., p. 405. For species for which no page is given see Harmer (1926, pp. 422–8).

Since the block was made for this map I have seen Osburn's paper on *Cornucopina antillea* from 732 m. in the West Indian region (see p. 398).

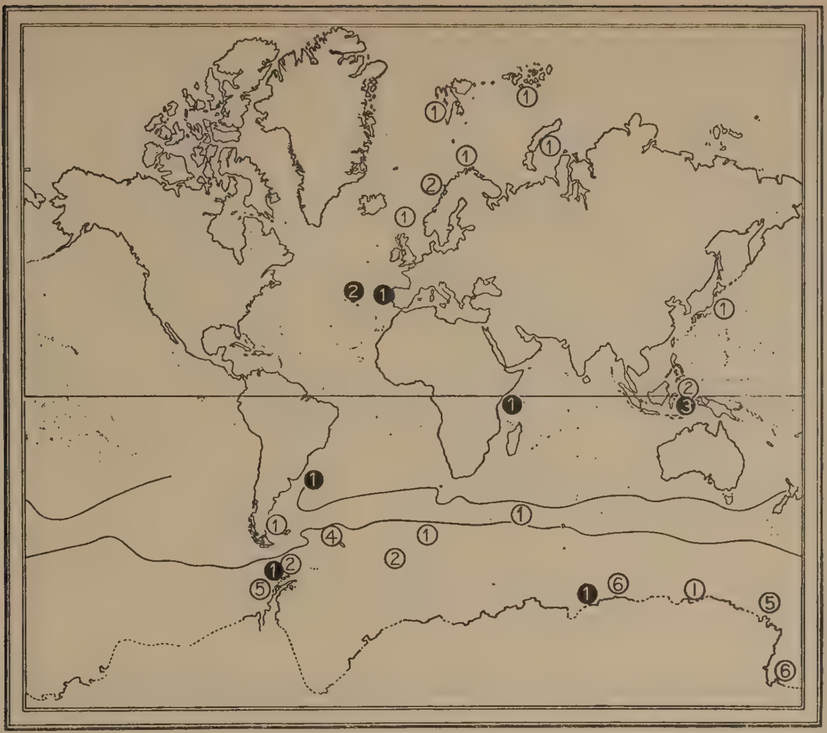

Fig. 65. Map to show the distribution of the genus *Notoplites*, based on distribution of: *N. antarcticus* (Waters), p. 341; *N. avicularìae* (Yanagi and Okada); *N. biloba* (Busk); *N. crassiscutus* sp.n., p. 353; *N. crateriformis* (Busk); *N. drygalskii* (Kluge), p. 342; *N. elongatus* (Busk) and var., pp. 346, 348; *N. impar* Harmer, 1926, p. 354; *N. jeffreysii* (Norman); *N. klugei* (Hasenbank), p. 352; *N. marsupiatus* (Jullien); *N. normani* (Nordgaard); *N. obliquidens* Harmer, 1926, p. 355; *N. perditus* (Kluge), p. 355; *N. rostratus* Harmer, 1926, p. 352; *N. scutatus* Harmer, 1926, p. 353; *N. smittii* (Norman); *N. tenuis* (Kluge) and var., pp. 350, 351; *N. undulatus* Hasenbank, 1932, p. 371; *N. vanhöffeni* (Kluge), p. 346; *N. watersi* (Kluge), p. 342. For species for which neither reference nor page is given see Harmer (1923, pp. 350–3).

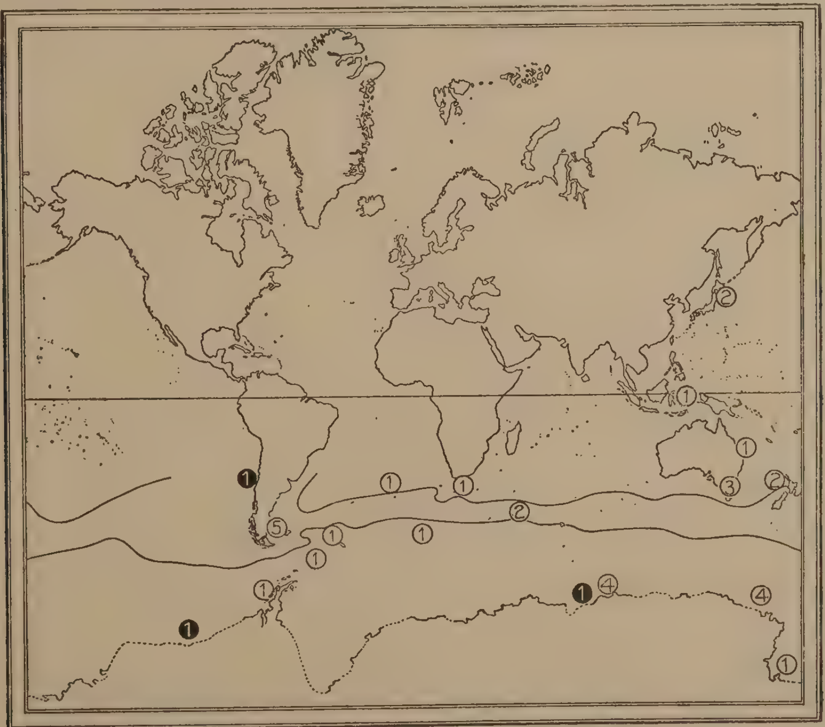

Fig. 66. Map to show the distribution of the genus *Amastigia*, based on distribution of: *A. abyssicola* (Kluge), p. 331; *A. antarctica* (Kluge), p. 329; *A. benemunita* (Busk), p. 325 (record near southern end of Chilean coast, Challenger St. 308, accidentally omitted); *A. cabereoides* (Kluge), p. 327; *A. crassimarginata* (Busk), p. 331; *A. funiculata* (MacGillivray), see Harmer, 1923, p. 335; *A. gaussi* (Kluge), p. 323; *A. harmeri* sp.n., p. 322; *A. kirkpatricki* Harmer, p. 327; *A. nuda* Busk, p. 321; *A. pateriformis* (Busk), p. 330; *A. rudis* (Busk), see Harmer, 1923, p. 332; *A. solida* (Kluge), p. 330; *A. vibraculifera* sp.n., p. 327; *Amastigia* sp. (A specimen of an undescribed species from Japan, 62.7.16.69.)

north of the sub-Antarctic, whereas there are eight from the Malay Archipelago, five from Australia, four from New Zealand and three from Japan.[1] *Caberea* and *Beania* are more widely distributed, but both have their greatest concentration of species in the Australasian region. Information from other groups is scanty. John (1937, p. 87) found South American affinities for the Antarctic Echinoderms, but the few other groups for which I have comparable data[2] seem to show the same tendency as the Polyzoa, the northward part of their range extending around the Australasian and eastern Asiatic land masses rather than around the American continent.

Table 6 summarizes the distribution of the recent species of the six predominantly Antarctic genera of Cellularine Polyzoa.

Table 6. *Summary of the distribution of the recent species of the six predominantly Antarctic genera of Cellularine Polyzoa*

The figures indicate the number of species recorded from each locality. Those in heavy type were taken at depths greater than 1000 m.

	Additional localities	North Atlantic	Tropical America (east coast)	Off subtropical South America	Sub-Antarctic	Antarctic (Weddell Quadrant)	Antarctic (Victoria Quadrant)	Indian Ocean	New Zealand	Australia	Malay Archipelago	Japan
Camptoplites		.	.	**1**	3+**2**	8	9+**2**	.	.	.	**1**	.
Farciminellum		**1**	1	.	1	1	1+**1**	**1**	.	.	**1**	.
Himantozoum		**2**	.	**1**	2	1	1+**1**	2+**2**	.	.	2+**1**	.
Cornucopina		.	2	**1**	2+**2**	3	3+**3**	**1**	**2**	2	3+**3**	.
Notoplites	Arctic **2**	2+**2**	.	**1**	1	7+**1**	6+**1**	**1**	.	.	2+**3**	1
Amastigia	S. Africa 1	.	.	**1**	6	1+**1**	4+**1**	.	2	3	1	2

The Polyzoa of Australasia and the Malay Archipelago have been much more intensively studied than those of South America, although the Central and North American Polyzoa are relatively well known, and the rarity of species of these Antarctic genera in South American waters may thus only be apparent. If it were a real peculiarity of distribution it could only be explained in relation to the geological history of the region and of the genera. Unfortunately, the Cellularine Polyzoa are not commonly preserved as fossils, owing to their delicate structure. Canu's papers on fossils from the Argentine (Canu, 1908, 1911) do not include any Cellularina, but a number of species are described from the Tertiary beds of Australia and New Zealand by MacGillivray, Waters and Maplestone. Mostly they are difficult to place generically, but typical species of *Amastigia* and *Caberea* are recognizable amongst them. For instance, *Menipea lineata* MacGillivray

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[1] See Addendum, p. 501.

[2] Serolidae (Sheppard, 1933, p. 264), *Cephalodiscus* (John, 1931, pp. 256–259), Nototheniiformes (Norman, 1938, p. 95).

(1895) and *Scrupocellaria glomerata* Maplestone (1900) both appear to belong to *Amastigia* as now understood. *A. acuminata* Maplestone (1900), on the other hand, appears to be wrongly attributed to the genus.

SEASONAL DISTRIBUTION OF ANCESTRULAE

Quite a large number of ancestrulae have been mentioned in this report, and the idea at once comes to mind that some evidence of the extent of the breeding period might be obtained from them, for the Cellularine ancestrulae soon break away or become enveloped in rootlets, and are therefore usually only found on small, young colonies.

Tables 7 A and B summarize the facts obtained from the collections of Antarctic and sub-Antarctic material examined by me.

The tables are based on the three big collections which I myself have examined, namely, the collections of the Discovery, the National Antarctic and the Terra Nova expeditions. I do not claim to have found all the ancestrulae, nor even to have searched for them specially, but I have picked over the whole of the material for other purposes, and every ancestrula noticed has been preserved. Thus the tables can be regarded as based on a fairly uniform sampling of the material. They are, however, inconclusive for various reasons.

In the first place it must be remembered that the ancestrulae are known in only a small proportion of species. Further, it is immediately evident that the abundance of ancestrulae reflects to some extent the intensity of collecting, as indicated by the number of stations per month yielding adult colonies. The average number of ancestrulae per station shows some increase in the warmer months, but this may be due to the chances of a single rich haul. Nearly all the January Antarctic records came from four stations, two of which were made within four days of each other in the Ross Sea; and more than half the February Antarctic records were from a single station (St. TN 194).

Nevertheless, there appears to be a distinct tendency in the Antarctic for the ancestrulae only to be found in January, February or March, although adult colonies of the species were collected over a period of 4–7 months. In view of the factors just discussed, I am not sure, however, that this appearance is statistically significant, especially as the few ancestrulae of known date that have been recorded from other collections extend the seasonal range of the ancestrulae as follows:

Camptoplites 4 (*Bugula reticulata* var. *spinosa* Waters, figured), Bellingshausen Sea, 18 October 1898.

Camptoplites sp. (*Bugula reticulata* var. *spinosa* Waters, unfigured), Bellingshausen Sea, 20 December 1898.

Camptoplites areolatus (var. *variospinosa* Kluge), Gauss-station, 24 April 1902.

Camptoplites 3 (*Bugula multispinosa* Kluge), Gauss-station, 14 June 1902.

These ancestrulae (which are discussed on pp. 436–441) have been omitted from the table in order that the data given may be based entirely on my sampling and so have, as far as possible, a uniform statistical value.

The stragglers in the sub-Antarctic table may be misleading. The ancestrulae of

Table 7. *Seasonal distribution of Ancestrulae in the Discovery, National Antarctic and Terra Nova Collections*

	No. of stations at which adults were taken	No. of stations at which ancestrulae were taken	Months in which species were collected. Where ancestrulae were taken their number is given. A cross means that only adult colonies were obtained											
A. Sub-Antarctic			IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII
Menipea flagellifera	23	2	.	.	.	.	+	+	+	2	.	+	+	.
Notoplites elongatus	2	1	.	.	.	.	.	.	.	1	.	.	.	.
Tricellaria aculeata	20	1	.	.	+	+	.	+	1	+	+	+	+	.
Caberea darwinii	22	4	+	.	+	.	.	+	+	13	+	+	+	.
Caberea rostrata	3	1	.	.	2	.	+	.	.	.	.	.	.	.
Beania costata var. *maxilla*	1	1	.	.	.	.	.	.	1	.	.	.	.	.
Camptoplites 2 (*C. atlanticus*)	4	1	.	3	.	.	+	.	.	+	.	.	+	.
Scruparia ambigua	4	1	.	.	+	.	.	8	.	+	.	.	.	.
Unnamed ancestrulae	.	6	.	.	1	.	.	1	.	3	.	.	1	.
Number of ancestrulae per month			.	3	3	.	.	9	2	19	.	.	1	.
Stations per month yielding ancestrulae			.	1	1	.	.	1	2	4	.	.	1	.
Stations per month yielding Cellularine Polyzoa			1	2	6	4	4	5	13	13	6	6	10	.
B. Antarctic			IX	X	XI	XII	I	II	III	IV	V	VI	VII	VIII
Amastigia solida	1	1	.	.	.	.	.	1	.	.	.	.	.	.
Notoplites antarcticus	1	3	.	.	.	.	3	+	2	+	.	.	.	.
Notoplites drygalskii	34	1	.	.	+	+	+	3	+	+	.	.	.	.
Notoplites tenuis	18	8	.	.	.	.	20	2	9	.	.	.	.	.
Caberea darwinii	27	6	.	.	.	1	2	4	+	1	.	.	.	+
Cornucopina pectogemma	9	1	.	.	.	+	+	2	+	+	.	.	.	.
Cornucopina polymorpha	13	1	.	.	.	+	+	+	2	.	.	.	.	.
Beania erecta	8	1	.	.	.	.	1	+	+	.	.	.	.	.
Himantozoum antarcticum	25	2	.	+	+	+	7	2	+	+	.	.	.	.
Camptoplites 5 (*C. retiformis*)	17	2	.	.	.	+	3	+	+	.	.	.	.	.
Camptoplites 6 (*C. angustus*)	9	3	.	.	.	.	2	+	3	.	.	.	.	.
Camptoplites 7 (*C. bicornis* var. *elatior*)	4	2	.	.	.	.	+	1	1	.	.	.	.	.
Camptoplites 1	.	2	.	.	.	.	4	.	.	.	.	.	.	.
Camptoplites 3	.	4	.	.	.	.	3	.	1	.	.	.	.	
Camptoplites 4	.	2	.	.	.	.	.	.	3	.	.	.	.	.
Unnamed ancestrulae	.	5	.	.	.	.	3	1	.	.	.	.	.	.
Number of ancestrulae per month			.	.	.	1	48	16	21	1	.	.	.	.
Stations per month yielding ancestrulae			.	.	.	1	7	3	7	1	.	.	.	.
Stations per month yielding Cellularine Polyzoa			2	1	4	5	29	15	19	3	1	1	.	2

Camptoplites 2 taken in October and the unnamed ancestrula taken in July were obtained from stations beyond the edge of the continental shelf (Sts. WS 773 and WS 237), where seasonal influences must be different; and the November ancestrulae came from Tristan da Cunha at the northern limit of the sub-Antarctic area (see p. 484). The tendency for the ancestrulae in typically sub-Antarctic localities to be found in February, March and April may thus be more definite than appears, at first sight, from the table.

On the other hand, the collecting chances have influenced this table even more than the Antarctic one, for eighteen of the nineteen April ancestrulae were collected on a single day at Marion Island and Prince Edward Island (Sts. 1562, 1563, 1564).

An ancestrula of *Beania costata* in the U.S. National Museum's Falkland Collection was taken on 22 April 1927, but is not included in the table.

NOTE ON THE VERMIFORM BODIES FOUND IN SOME POLYZOA

Bodies of various types have frequently been observed in the body-cavity of the Polyzoa and described as "gland-like bodies", "vermiform bodies", "enigmatic bodies", "sausage-like bodies", etc. They probably comprise more than one type of structure.

There are, for instance, the paired organs, placed one on each side of the operculum, usually known as opercular glands. Harmer (1926, p. 480) noted that these organs appear to open into the vestibule and might possibly be testes (as suggested by various authors), poison glands, slime glands or excretory organs. The median gland-like structure in *Cigclisula* (see *Lepralia occlusa* Waters, 1909, p. 152, *Cigclisula cautium* Hastings, 1932, p. 435) seems to be of the same type.

Others do not have any apparent connexion with the vestibule and orifice. They may be paired or unpaired, and, within the species, may be fairly constant in form and position, or very variable. It is not certain that they are all of the same nature and some may even be parasites. Their nature could probably only be determined by examination of fresh and specially preserved material, which is not possible at present (March, 1941). It may, however, be useful to remind workers of the existence of this problem, and to set down the main facts at present known.

Busk (1884, p. 58) described "bands" in the zooecia of specimens of *Carbasea pisciformis* from Bass Strait. He described them as thick-walled epithelial tubes closed at both ends. He could discover nothing about the contents of the tubes. He regarded them as part of the Polyzoa and distinguished them from the "parasitic vermicules" which he also found. They are clearly visible in a slide made from his material (87.12.9.281)[1] and are very constant in their position, lying one on each side of the zooecium, close to the lateral walls and extending the whole length of the zooecium. Busk compared them to the horseshoe-shaped body which he described in *Onchoporoides moseleyi*. Unfortunately, no material of this species is accessible to me at present,[1] and it is some years since I examined it. My recollection is, however, that these horseshoe-shaped structures are incipient ovicells. In any case it appears from Busk's description of them as cavities in the calcareous frontal wall that they are very different in nature from the bands in the body-cavity of *Carbasea pisciformis*.

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[1] Busk's own slides of *Carbasea pisciformis* and *Onchoporoides moseleyi* have been sent out of London for safety.

Waters (1904, p. 21) described a pair of vermiform bodies in one of the varieties of *Camptoplites bicornis*. (Kluge has shown that *Bugula bicornis* Waters comprised three varieties, but not the typical form; see Kluge, 1914, pp. 619, 622, 623 for synonymy.) Waters described them as arising from the frontal membrane and regarded them as part of the Polyzoan, and "undoubtedly equivalent to the gland-like body" to which he had frequently referred. His paper on gland-like bodies (1892) does not, however, show anything very much like them, and chiefly describes undoubted organs of the Polyzoa such as the paired opercular glands and the vestigial polypides of avicularia. In 1909 (p. 132) and 1913 (pp. 474, 476) Waters recorded similar vermiform bodies in various members of the Scrupocellariidae and regarded them as in some way to do with the testis.

Palk (1911), working at Naples, described similar bodies in *Carbasea papyrea* (Pall.) which she treated as synonymous with *C. carbasea* Ell. & Sol. They were attached by one end to the frontal membrane "outside the occlusor muscles", and were very variable in shape, being variously coiled, looped and sometimes constricted. She found something in the nature of an epithelial wall and a coiled, thread-like contents to the tube. In mass the threads suggested spermatozoa, but when teased out they appeared to form a continuous cord with darkly staining dots at intervals. The vermiform bodies were present in zooecia both with and without spermatic tissue, and were largest in those with brown bodies.

In external appearance Palk's bodies closely resemble those that I have found in several species of Antarctic Polyzoa, but I have no reason to think that my material has the thread-like internal structures. I have not, however, cut sections, and the material was preserved in spirit without special fixation.

In the collections discussed in this report I have noted the presence of vermiform bodies in the zooecia of some specimens of *Notoplites drygalskii*, *N. vanhöffeni*, *N. tenuis*, *Menipea flagellifera*, *Camptoplites giganteus* and *Beania magellanica*. They are not to be seen in every zooecium nor in every specimen. Except in *B. magellanica*, where their position is relatively constant, they do not appear to have an exactly fixed position in the zooecium.

In *B. magellanica* they are short and lie one on each side of the polypide at about the middle of the length of the zooecium, one frequently being a little more distally placed than the other.

Those that I have seen in *Menipea flagellifera* are single and stout, very irregularly placed in the zooecium and variously coiled.

In one specimen of *Notoplites tenuis* single, straight, rather stout bodies are to be seen in zooecia in which the body cavity contains great quantities of spermatic tissue, and in another specimen single ones of similar form are present in zooecia with brown bodies or with polypide buds.

In *N. drygalskii* and *N. vanhöffeni* they may much resemble those shown in Palk's fig. 1 or, more commonly, the two lateral bands may be continuous proximally forming a single U-shaped body of considerable length.

In *Camptoplites giganteus* the zooecia may contain single, very long, coiled, almost tangled, bodies, which are more slender and less coarsely granular than those of *Notoplites drygalskii*.

The distribution of the bodies in the colony and their position in the zooecia appear to bear no special relation either to the reproductive phase of the colony or to the state of the polypide. They usually stain less readily than the other tissues with borax carmine.

Except, perhaps, in *Beania magellanica*, they seem to me to suggest parasites rather than organs of the Polyzoa, and I have therefore shown those in *Notoplites drygalskii* to Dr H. A. Baylis and Professor Doris Mackinnon. Both authorities found it impossible to come to any decision about them without fresh, properly fixed material, but both suggested very tentatively that they might perhaps be Protozoa. Dr Baylis reported that they were certainly not worms.

ADDENDUM

Dr Silén's paper on *Cheilostomata Anasca* from Japan and the Bonin Islands (Ark. Zool. Stockholm, 33A, 1942) did not reach me till August, 1942, when this report, which was completed in July, 1941, was in page-proof. He describes a new species of *Camptoplites* of the *C. bicornis* group, extending the range of the genus to Japan, and a new species of *Tricellaria* of the *T. sympodia* group.

Professor Marcus's work on *Bryozoa* from Brazil (Bol. Zool. São Paulo, 5, 1941) did not reach me till April, 1943. He discusses the distribution of *Caberea boryi*.

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INDEX

k indicates where keys are to be found

Abyssal species, distribution of, 484
abyssicola, Amastigia, 320, **331**, 481, 485, 495
abyssicola, Bugula, 452
abyssicola, Scrupocellaria, 331
abyssicolus, Camptoplites, 436, 441, 442 *k*, **452**, 453, 481, 485, 493
aculeata, Bicellaria, 356
aculeata, Menipea, 357
aculeata, Tricellaria, 333, 335, 340, **356**, 480, 487, 498
acuminata, Amastigia, 497
aegyptiaca, Loricaria, 391
aegyptiacum, Synnotum, **391**, 491
Aetea, **471**
alice, Farciminellum, 493
Allantopora, 470
Amastigia, **320** *k*, 492, 495, 496, 497
Amastigia *sp.*, **320** *k*, **327**, 495
ambigua, Eucratea, 475
ambigua, Scruparia, **475**, 479, 482, 487, 491, 498
Ancestrula of Amastigia benemunita, **327**
  of Amastigia solida, **330**
  of Beania costata, **409**
  of Beania costata *var.* maxilla, **409**
  of Beania erecta, **417**
  of Brettia inornata, **476**
  of Bugula cucullata *var.* cuspidata, **429**
  of Caberea boryi, **368**
  of Caberea darwinii, **384**
  of Caberea helicina, **370**
  of Caberea rostrata, **390**
  of Camptoplites, **436–441**
  of Camptoplites angustus, **441**
  of Camptoplites areolatus, 441, **466**
  of Camptoplites atlanticus, **440**
  of Camptoplites bicornis *var.* elatior, **441**
  of Camptoplites retiformis, **441**
  of Camptoplites *species* **1**, 438 *k*, **439**, 498
    species **2**, 439 *k*, **440**, **460**, 498, 449
    species **3**, **438**, 439 *k*, **440**, 497, 498
    species **4**, **438**, 439 *k*, **441**, 497, 498
    species **5**, **438**, 439 *k*–**441**, 498
    species **6**, **438**, 439 *k*–**441**, 498
    species **7**, 438 *k*, **441**, 498
  of Cornucopina pectogemma, **398**
  of Cornucopina polymorpha, **400**
  of Himantozoum antarcticum, **423**
  of Menipea flagellifera, **335**
  of Menipea patagonica, **335**
  of Notoplites, 340
  of Notoplites antarcticus, **341**
  of Notoplites drygalskii, **346**
  of Notoplites elongatus, **348**
  of Notoplites tenuis, **350**
Ancestrula of Scruparia ambigua, 476
  of Scrupocellaria frondis, **364**
  of Tricellaria aculeata, 335, **358**
Ancestrulae, seasonal distribution of, 497
anguina, Aetea, **471**, 474, 479, 484, 487, 491
anguina, Sertularia, 471
angulata, Bicellaria, 406
angulata, Cornucopina, 397 *k*, **406**, 481, 485, 494
angusta, Bugula, 452
angusta, Caberea, 366, 367 *k*, **389**, 491
angustus, Camptoplites, 434–436, 441, 442 *k*, **452**, 480, 493, 498
Antarctic area defined, 477
Antarctic type of Caberea darwinii, 325, **379**, 383, 389
antarctica, Amastigia, 321 *k*, **329**, 481, 495
antarctica, Anderssonia, 329
antarctica, Flustra, 422
antarctica, Scrupocellaria, 341, 342
antarcticum, Farciminellum, **391**, 480, 490, 493
antarcticum, Himantozoum, 395, 398, **422**, 480, 489, 490, 494, 498
antarcticus, Notoplites, 339, 340 *k*, **341**, 342, 355, 480, 490, 495, 498
antillea, Cornucopina, 398, 492, 494
apsteini, Bugula, 423, 424
apsteini, Himantozoum, 423, 494
aquilina, Tricellaria, 359, 360
arachnoides, Canda, **364**, 491
areolata, Bugula, 465
areolatus, Camptoplites, 340, 434, 436, 441, 442 *k*, 455, 462, 464, **465**, 468, 480, 489, 493
armata, Levinsenella magna *var.*, 393
aspera, Camptoplites latus *var.*, 436, 442 *k*, 455, 457, **458**, 480, 490
asymmetricus, Camptoplites, 434, 436, 441, 442 *k*, 455, 463, **466**, 480, 487, 489, 490, 493
atlanticum, Farciminellum, 493
atlanticus, Camptoplites, 395, 434, 435, 436, 440–442 *k*, 455, **460**, 479, 487, 489, 493, 498
attenuata, Catenaria, 476
australis, Aetea, 475
aviculare, Synnotum, 391
avicularia *forma* flabellata, Bugula, 427
aviculariae, Notoplites, 495

Beania, 395 *k*, **408**, 420, 421, 423, 492, 496
bella, Cornucopina, 494
benemunita, Amastigia, 321 *k*, **325**, 331, 479, 487, 495
benemunita, Menipea, 321, 325, 480
bertholletii, Scrupocellaria, 361, 363
Bicellariella, 395 *k*, **396**
Bicellariella *sp.*, **396**, 479, 487

Bicellariellidae, key to genera of, 394
bicornis, Bugula, 443, 500
bicornis, Camptoplites, 434–436, 439, 441 *k*, **443**, 447, 450, 451, 481, 485, 489, 493, 500, 501
bifurcata, Scrupocellaria, 357, 358
bilaminata, Beania, 414, 415
biloba, Notoplites, 495
birostrata, Bugula (Dendrobeania), 434
biseriata, Flustra, 394
biseriata, Kenella, **394**, 423, 481, 485
borealis, Levinsenella, 394
boryi, Caberea, 365, 366 *k*, **367**, 369, 370, 371, 373–375, 379, 381, 385, 386, 480, 491, 501
boryi, Crisia, 367, 374
brasiliensis, Acamarchis, 430
Brettia, 303, 476, 492
Brettia *sp.*, 470
British Museum Catalogue, 304
British Museum registration numbers, 303
Bugula, 395 *k*, 421, 426, 435, 445, 492
Bugularia, 421
Busk drawings, 303, 375, 386
buski, Klugella, 420–**422**, 479

Caberea, 320 *k*, **365**, 492, 496
Caberea *sp.*, **390**, 479, 483
cabereoides, Amastigia, 321 *k*, 323, **327**, 329, 481, 495
cabereoides, Scrupocellaria, 327
calathus, Bugula, **426**, 429, 430, 491
calveti, Notoplites elongatus *var.*, 341 *k*, **348**, 353, 479, 487, 489
Camptoplites, 395 *k*, 431, **433**, 483, 489, 492, 493, 496, 501
Camptoplites, *ancestrulae of*, **436–441**
Camptoplites *sp.*, 497
Canda, 320 *k*, **364**
capensis, Bicellariella, 396
caraibica, Canda, 364
carbasea, Carbasea, 500
Caulibugula, 394 *k*, **433**
cautium, Cigclisula, 499
Cellaria, 374, 381
Cellepora, 429
cervicornis, Scrupocellaria, 363
Challenger Collection, 304
Challenger St. 142, conditions at, 383
challengeri, Beania, 408 *k*, **415**, 417, 479
chelata, Scruparia, 482
chuakensis, Bicellariella, 396
Cigclisula, 499
cirrata, Cellaria, 332
cirrata, Cellularia, 332–334, 480
cirrata, Maplestonia, 477
cirrata, Menipea, 332
cirrhata, Menipea, 332
clypeata, Canda, 365
compacta, Bugula bicornis *var.*, 445
compacta, Camptoplites bicornis *var.*, 434, 440, 443–445 *k*, 480
conica, Cornucopina, 397 *k*, **398**, 399, 481, 483, 485, 494
cornigera, Scrupocellaria, 363
Cornucopina, 395 *k*, **396**, 492, 494, 496
cornuta, Dimetopia, 491
cornuta, Himantozoum leontodon *forma*, 424
Corynoporella, 470
costata, Beania, **408** *k*, 410, 479, 487, 499
costata, Diachoris, 408
crassa, Flustra, 420, 422
crassimarginata, Amastigia, 321 *k*, **331**, 479, 486, 487, 495
crassimarginata, Caberea, 331
crassimarginata, Canda, 331
crassiscutus, Notoplites, 339, 340 *k*, **353**, 480, 490, 495
crateriformis, Notoplites, 495
crispa, Cellularia, 332
crispa, Menipea, **332** *k*, 491
crosslandi, Aetea, 475
cucullata, Bugula, 427–429
cupulariensis, Beania, 420
curta, Aetea, **473**, 479, 491
cuspidata, Bugula cucullata *var.*, **427**, 430, 491
cuspidata, Bugulopsis, 356
cuspidata, Cellularia, 356
cyathus, Emma, 320, 358
cyathus, Menipea, 358

darwinii, Caberea, 325, 365–367 *k*, 371, 373, **374**, 385, 390, 480, 482, 484, 487, 489, 492, 498
Dendrobeania, 421
dentata, Acamarchis, 429
dentata, Bugula, 427, **429**, 482, 491
diadema, Scrupocellaria, 363
discodermiae, Beania, 408 *k*–**410**, 491
discodermiae, Diachoseris, 410
Discoloration of Terra Nova specimens, 303
distans, Beania, 415
distans, Beania magellanica *var.*, 415
Distribution in relation to hydrology, 491
Distribution of ancestrulae seasonal, 497
Distribution of Caberea darwinii *discussed*, 382
Distribution of genera, 492
Distribution of species, 477
Distribution outside sub-Antarctic and Antarctic areas, 491
ditrupae, Bugula, 430
dolabrata, Caberea glabra *var.*, 382
drygalskii, Notoplites, 339, 340 *k*, **342**, 346, 480, 490, 495, 498, 500, 501
drygalskii, Scrupocellaria, 342
dubitata, Bicellaria, 399
dubitata, Cornucopina, 399, 400

echinata, Flustra, 420, 421
echinata, Klugella, 420, **421**, 481
elatior, Bugula bicornis *var.*, 445, 447
elatior, Camptoplites bicornis *var.*, 441, 443–445 *k*–**447**, 480, 498

ellisii, Caberea, 368
elongata, Beania, 412
elongata, Bugula bicornis *var.* magna *forma*, 445
elongata, Camptoplites bicornis *var.* magna *forma*, 443, 445
elongata, Cellularia, 346, 348
elongatus, Notoplites, 339–341 *k*, **346**–349, 353, 479, 483, 495, 498
emaciatum, Himantozoum, 494
Emma, 320 *k*, 358, **360**
Enigmatic bodies, 499
erecta, Beania, 408 *k*, **416**–419, 480, 490, 492, 498
Erymophora, 395 *k*, **469**, 492
Erymophora *sp.*, **469**
expansa, Bugula, 491

Farciminellum, **391**, 492, 493, 496
flabellata, Bugula, 426, 427
flabellata, Bugula avicularia *forma*, 427
flagellifera, Menipea, 332 *k*, **335**–337, 479, 487, 498, 500
flagellifera, Scrupocellaria, 335
fragilis, Beania, 408 *k*, 411, **413**, 479, 487
fragilis, Chaunosia, 413
frondis, Scrupocellaria, **361**, 491
fuegensis, Aetea, 475
fuegensis, Menipea, 357
fuegensis, Scrupocellaria, 357
fuegensis, Tricellaria, 357–359
funiculata, Amastigia, 320 *k*, 495
funiculata, Menipea, 342
funiculata, Scrupocellaria, 331

gaussi, Amastigia, 321 *k*, **322**, 329, 480, 487, 490, 495
gaussi, Scrupocellaria, 322
geniculata, Cornucopina, 494
gigantea, Bugula, 451
giganteus, Camptoplites, 434–436, 442 *k*, 444, 449, **451**, 480, 490, 493, 500, 501
glabra, Caberea, 325, 365, 375, 379, **381**, **383**, 491
Gland-like bodies, 499
glomerata, Scrupocellaria, 497
gracilis, Brettia pellucida *var.*, 469, 470
gracilis, Erymophora, **470**, 471
grandis, Bicellaria, 403
grandis, Cornucopina, 402–404, 406, 489, 494
guntheri, Caberea darwinii *var.*, 367, **386**, 479, 487, 489

harmeri, Amastigia, 321 *k*, **322**, 325, 491, 495
hastata, Catenicella, 332
Head-angles of avicularia defined, 396
helicina, Caberea, 365, 366 *k*, **368**, 373–375, 491
hessei, Himantozoum, 494
hexagona, Farciminaria, 393
hexagonum, Farciminellum, **393**, 478, 480, 483, 493
Himantozoum, 395 *k*, **422**, 492, 494, 496
hirtissima, Beania, 411, 413, 414
hyadesi, Beania, 411
hyadesi, Bugula, **430**, 479, 492
hyadesi, Diachoris, 411
hydesia, Beania, 411
Hydroid on Kenella biseriata, 394

impar, Notoplites, 495
Indian Ocean, islands of, 483
inermis, Beania, 408 *k*, 409, **411**–413, 479, 487
inermis, Diachoris, 411
infantae, Cellularia, 332
infundibulata, Bicellaria, 399
infundibulata, Cornucopina, 397 *k*, **399**, 400, 481, 484, 485, 494
inornata, Alysidium, 476
inornata, Brettia, **476**–479
intermedia, Beania, 408 *k*, **419**, 491
intermedia, Diachoris, 419

jeffreysii, Notoplites, 495
Johnston Collection, 304
johnstonae, Bugula, 431

kempi, Menipea, 332 *k*, **336**, 479
Kenella, **394**
Kinetoskias, 394 *k*, **433**
kirkpatricki, Amastigia, 320, 321 *k*, 323, **327**, 340, 348, 479, 495
kirkpatricki, Caberea, 327
klugei, Erymophora, **470**, 480
klugei, Menipea, 352
klugei, Notoplites, 339, 340 *k*, **352**, 480, 495
Klugella, 394 *k*, **420**, 422, 492

lata, Bicellaria, 402
lata, Bugula, 458
lata, Caberea, 368
lata, Cornucopina, 397 *k*, **402**, 481, 494
latus, Camptoplites, 434, 436, 442 *k*, 455–**458**–460, 462, 489, 490, 493
leontodon, Himantozoum, 424, 494
Levinsenella, **393**
levinseni, Bicellariella, 396
lewaldi, Bugula, 449
lewaldi, Camptoplites, 434–436, 442 *k*, 444, **449**, 451, 481, 493
ligulata, Aetea, 475
ligulata, Menipea, 332 *k*
lineare, Farciminellum, **393**, 481, 485
linearis, Flustra, 393
lineata, Menipea, 496
livingstonei, Beania erecta *var.*, 416, **417**, 480, 490
longa, Brettia, 352, 470, 471
longicauda, Bugula, 431
longissima, Bugula, 395, **431**, 433, 479, 482, 483, 492
lophodendron, Bugula, 431
lunatus, Camptoplites, 433–436, 441, 442 *k*, **464**, 481, 485, 493
lyallii, Caberea, 371, 373, 374

Magellanic Region defined, 319
Magellanic Region, distribution in, 486

magellanica, Beania, 408 *k*, 412, **414**–418, 479, 487, 500, 501
magellanica, Diachoris, 414
magna, Camptoplites bicornis *var.*, 443–**445** *k*, 447, 480, 490
magna, Farciminaria, 393
magna, Levinsenella, **393**, 481, 485
Maplestonia, 477
margaritiferum, Himantozoum, 424, 494
marionensis, Menipea, 327, 331 *k*
marsupiatus, Notoplites, 495
maxilla, Beania costata *var.*, **409**–411, 479, 487, 498
maxilla, Diachoris, 409
Menipea, 320 *k*, **331**, 352, 492
minima, Caberea, 374–377, 381, 384
minima, Carbarea, 375
minima type of Caberea darwinii, 325, **377**, **379**–383, 491
mirabile, Himantozoum, 424, 494
mollis, Bugula, 394
moluccensis, Bicellaria, 406
moluccensis, Cornucopina, 396 *k*, 397, **406**, 491, 494
Monartron, 358
monotrypa, Cellularia, 356
monotrypa, Tricellaria, 332, **356**, 491
moseleyi, Onchoporoides, 499
multiserialis, Acamarchis, 430
multiseriata, Menipea, 332 *k*
multispinosa, Bugula, 497
multispinosus, Camptoplites, 440

navicularis, Bicellaria, 407
navicularis, Cornucopina, 406–408, 494
neritina, Bugula, 395, 424, **430**, 479
neritina, Sertularia, 430
nobilis, Beania, 421
Nolella, 472
normani, Notoplites, 495
Notoplites, 320 *k*, **339**, 492, 495, 496
nuda, Amastigia, **321**–326, 329, 479, 480, 487, 495

obliquidens, Notoplites, 495
obtusa, Menipea, 333, 334
obtusum, Himantozoum, 423, **424**, 479, 487, 489, 494
occlusa, Caberea darwinii *var.*, 374, 378, **385**
occlusa, Lepralia, 499
octaceras, Beania, 413
ornata, Menipea, 332 *k*
ornithorhynchus, Scrupocellaria, 360
ornithorhyncus, Scrupocellaria, **360**, 479, 484, 487, 491
ovalis, Cornucopina, 397 *k*, **402**–404, 480, 482, 490, 494

papyrea, Carbasea, 500
Patagonian region, distribution in, 486
Patagonian Shelf, conditions off, 489
Patagonian Shelf defined, 319
patagonica, Caberea, 373–375
patagonica, Canda, 375
patagonica, Menipea, 332 *k*, **333**, 337, 357, 359, 480, 487, 489, 490
patagonica, Scrupocellaria, 333
pateriformis, Amastigia, 321 *k*, 329, **330**, 481, 485, 495
pateriformis, Menipea, 330
paucispinosa, Beania, 413
peachii, Tricellaria, 340
pecten, Canda, 364
pectogemma, Bicellaria, 397
pectogemma, Cornucopina, **397** *k*, 480, 482, 484, 490, 494, 498
pellucida *var.* gracilis, Brettia, 469, 470
perdita, Scrupocellaria, 355
perditus, Notoplites, 339, 340, **355**, 481, 485, 495
petiolata, Beania, 409
pilosa, Scrupocellaria, 360
pisciformis, Carbasea, 499, 500
pocillum, Kinetoskias, **433**, 481, 483, 485
polymorpha, Bicellaria, 399
polymorpha, Cornucopina, 397 *k*–**399**, 480, 490, 494, 498
pribilofi, Tricellaria, 359
pulchella, Beania, 408 *k*, **414**, 420, 491
pusilla, Scrupocellaria, 363
Pyrulella, 413

quadrata, Cellularia, 337
quadrata, Menipea, 332 *k*, **337**, 479
quadriavicularis, Camptoplites bicornis *var.*, 434–436, 443–445 *k*–**447**–449, 451, 466, 480, 487, 489, 490
quadricornuta, Beania, 409, 412

recta, Aetea, 471, 474, 475
rectilinearis, Camptoplites, 434, 436, 442 *k*, 455, **462**, 481, 493
reticulata, Bugula, 462, 464–466, 468
reticulatus, Camptoplites, 433–436, 441, 442 *k*, 449, 455, **462**, 466, 481, 485, 493
retiformis, Bugula, 453
retiformis, Camptoplites, 422, 434, 436, 441, 442 *k*, **453**–459, 462, 466, 480, 490, 493, 498
retiformis, Canda, 364, 365
roborata, Menipea, 332 *k*, 338, 339
Ross Sea defined, 319
rostrata, Caberea, 366, 367 *k*, 371, 387, **389**, 479, 484, 491, 492, 498
rostratus, Notoplites, 495
rotundata, Bicellaria, 407
rotundata, Cornucopina, 397 *k*, **407**, 481, 485, 494
rudis, Amastigia, 321 *k*, 325, 326, 495

scalariformis, Tricellaria, 359
scotti, Beania, 408 *k*, **418**, 481, 492
Scruparia, **475**
Scrupariidae, 303
scrupea, Scrupocellaria, 361
Scrupocellaria, 320 *k*, **360**

Scrupocellariidae, key to genera of, 320
scutata, Canda pecten *var.*, 365
scutatus, Notoplites, 495
Siboga stations, conditions at, 486
simplex, Brettia, 477
simplex, Farciminaria, **391**–393
simplex, Maplestonia, 477
simplex, Menipea, 352
simplex, Notoplites, 352
simplex, Scrupocellaria, 352
sinuosa, Bugula, 425
sinuosum, Himantozoum, 423–**425**, 479, 483–485, 494
smittii, Notoplites, 495
solida, Amastigia, 321 *k*, **330**, 481, 495, 498
solida, Scrupocellaria, 330
South Georgia, distribution at, 489
spatulata, Scrupocellaria, 361, 363
spicata, Menipea, 332 *k*
spinosa, Bugula reticulata *var.*, 441, 464, 497
spinosa, Camptoplites reticulatus *var.*, 466
striata, Camptoplites latus *var.*, 442 *k*, 455, **458**, 459, 480
Sub-Antarctic area defined, 477
Swain's Bay type of Caberea darwinii, **379**, 383, 386, 389
sympodia, Tricellaria, 359, 501
Synnotum, **391**

taurinum, Himantozoum, 423, 426, 494
tenuis, Corynoporella, 470
tenuis, Notoplites, 339, 340 *k*, 348–**350**–354, 480, 490, 495, 498, 500
tenuis, Scrupocellaria, 350
tenuispina, Camptoplites retiformis *var.*, 442 *k*, **455**, 459, 480
ternata, Tricellaria, 358
transversa, Caberea, 366, 382
triangula, Emma, **360**, 491
Tricellaria, 320 *k*, **356**, 358, 492
Tricellaria *sp.*, **359**, 481, 485
tricornis, Bugula, 451
tricornis, Camptoplites, 434–436, 441, 442 *k*, **451**, 480, 490, 493
tridentata, Scrupocellaria, 363
triplex, Brettia, 303, **476**, 481
triseriata, Cellularia, 337
triseriata, Menipea, 331 *k*, 332, **337**, 491
truncata, Aetea, 473–475
tuba, Cornucopina, 494
tuberosa, Caulibugula, **433**, 491
turrita, Bugula, 430

umbonata, Catenicella, 332
undulatus, Notoplites, 495
unicornis, Beania inermis *var.*, **412**, 479, 487
unicornis, Camptoplites reticulatus *var.*, 435, 463, 464
uniserialis, Notoplites tenuis *var.*, 339, 340 *k*, **351**, 470, 471, 481

vanhöffeni, Beania, 412, 413
vanhöffeni, Notoplites, 339, 340 *k*, 342–344, **346**, 480, 495, 500
variabilis, Bugula sinuosa *var.*, 425, 426
variabilis, Himantozoum sinuosum *var.*, 424, **426**, 481, 485
variospinosa, Bugula *sp. var.*, 441, 465, 466
variospinosa, Camptoplites areolatus *var.*, 497
vectifera, Menipea, 320, 332 *k*, **339**, 491
ventricosa, Camptoplites bicornis *var.* magna *forma*, 443
Vermiform bodies, 499
versa, Cornucopina ovalis *var.*, 402–**404**, 479, 487, 489
versicolor, Bugula, 423
vibraculifera, Amastigia, 321 *k*, **327**, 479, 487, 495

watersi, Notoplites, 339, 340 *k*–**342**, 481, 495
watersi, Scrupocellaria, 342

zelandica, Caberea, 365, 366 *k*, 367, 370, **371**, 375, 379, 381, 390
zelandica, Cornucopina, 397 *k*, **405**, 494, 491
zelandica, Menipea, 332 *k*, **337**, 491
zelandica, Selbia, 371
zelanica, Caberea, 371, 373, 374

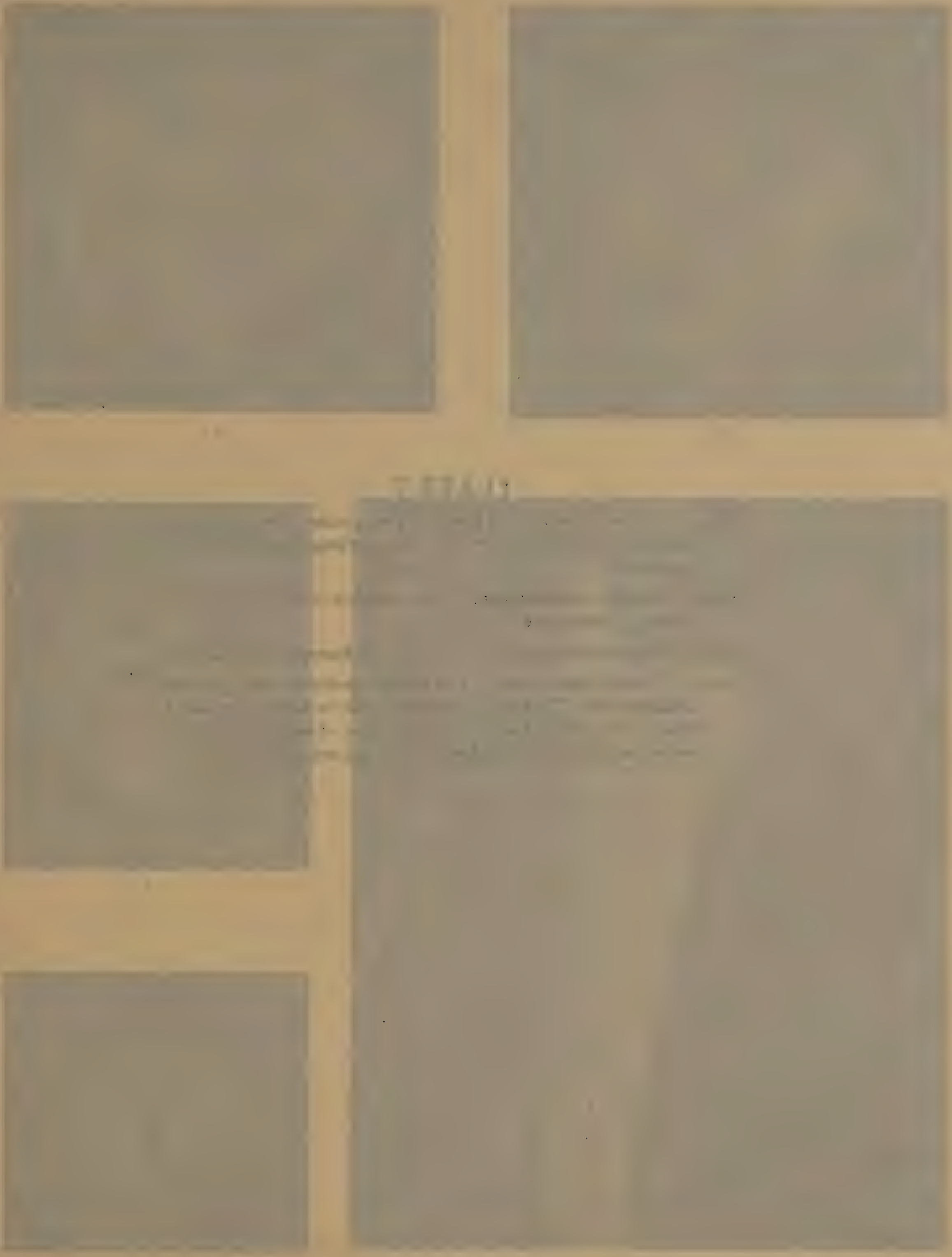


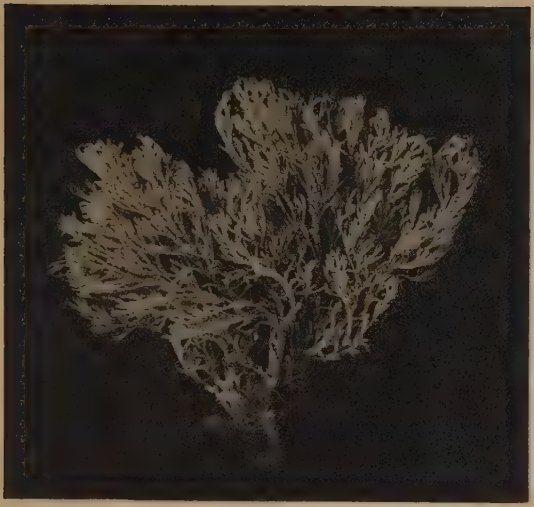
PLATE V

Figs. 1, 2. *Menipea patagonica* Busk. 1. Bushy colony. St. 145, South Georgia. 2. Feathery colony. St. WS 72, Patagonian Shelf. Both natural size.

Fig. 3. *Menipea zelandica* sp.n. Type-specimen from St. 935, New Zealand. Natural size.

Fig. 4. *Menipea roborata* (Hincks). 50.5.2.2. Australia. Natural size.

Fig. 5. *Menipea zelandica* sp.n. Part of type-specimen. St. 935, New Zealand. × 10. The rootlet-chambers are to be seen at the shaded edge of the branch, beside the avicularium of each marginal zooecium, and might be mistaken for a second avicularium.



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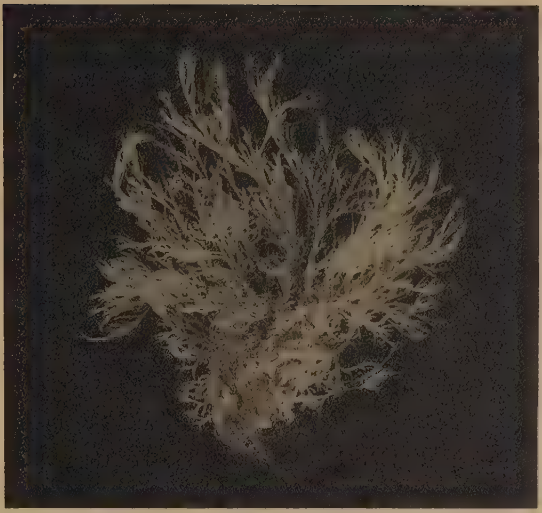

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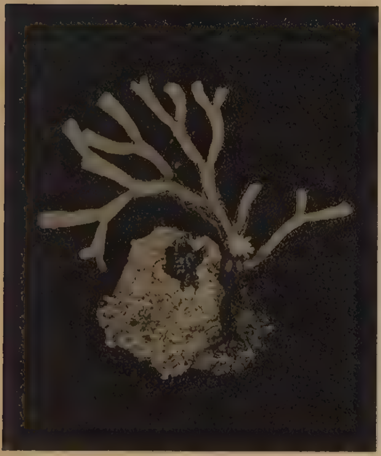

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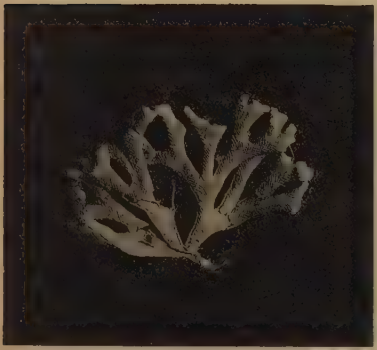

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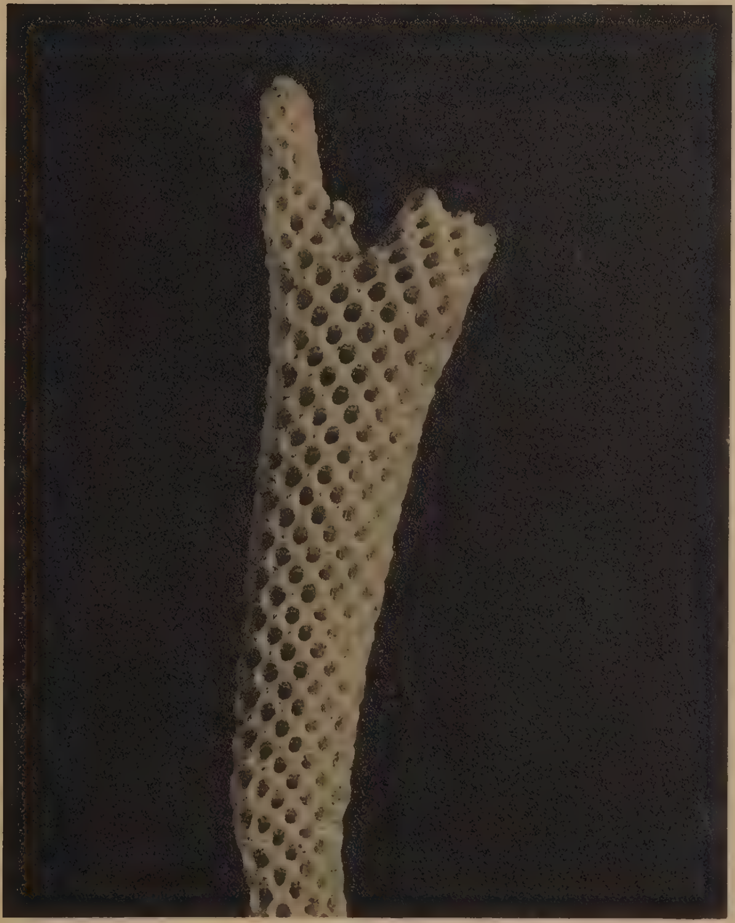

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PLATE VI

Figs. 1–3. *Caberea darwinii* Busk. 1. Type-specimen of *C. darwinii*, 99.7.1.855. Straits of Magellan. 2. Type-specimen of *C. minima* Busk, 87.12.9.144. Challenger St. 315. 3. Specimen approaching Antarctic type, 87.12.9.136. Challenger St. 148.

Fig. 4. *Caberea darwinii* var. *guntheri* var.n. Type-specimen, St. WS 840, off Patagonian Shelf.

Fig. 5. *Caberea zelandica* (Gray). 99.5.1.391. New Zealand.

Fig. 6. *Notoplites drygalskii* (Kluge). St. 1652, Ross Sea. All figures natural size.

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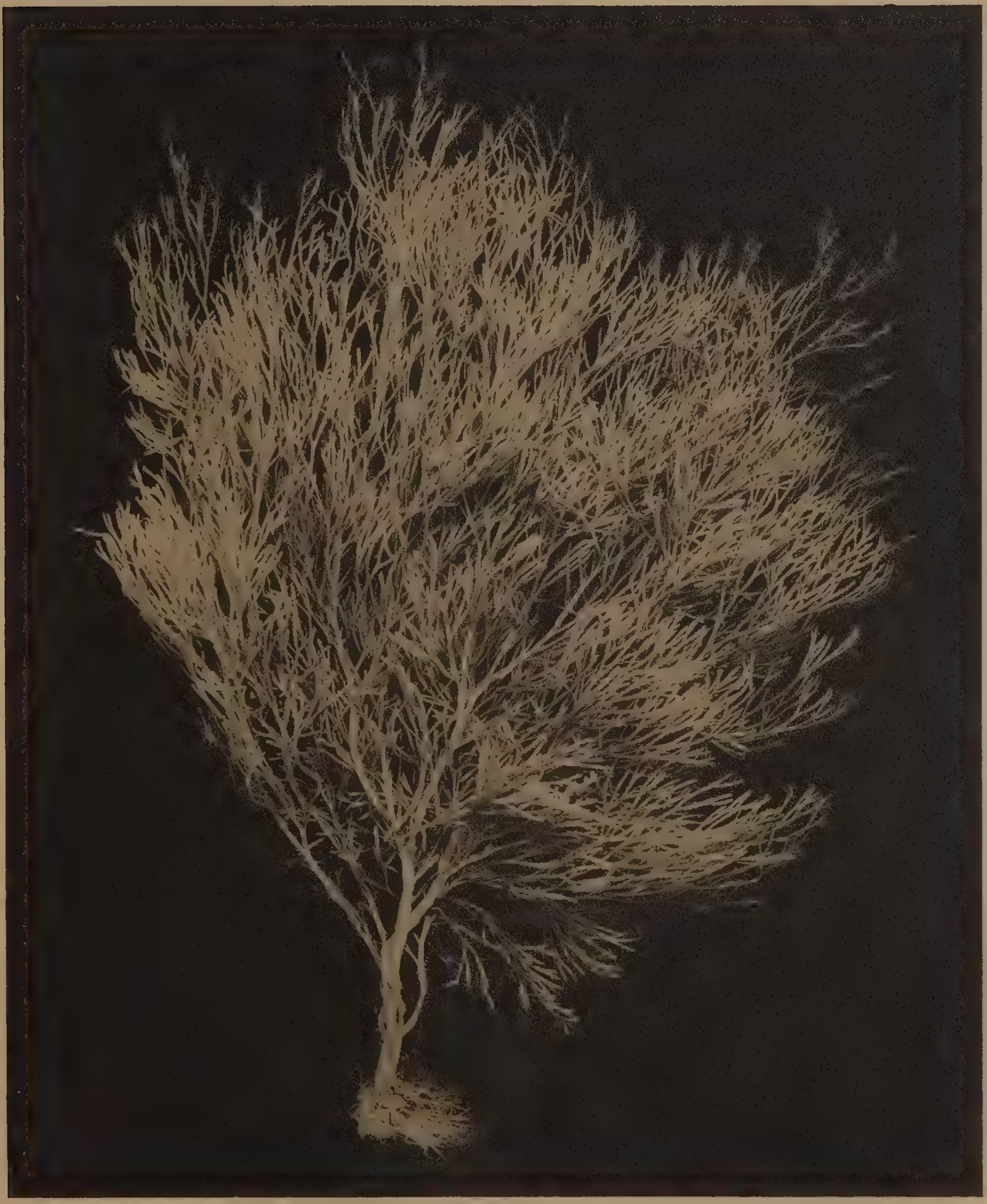

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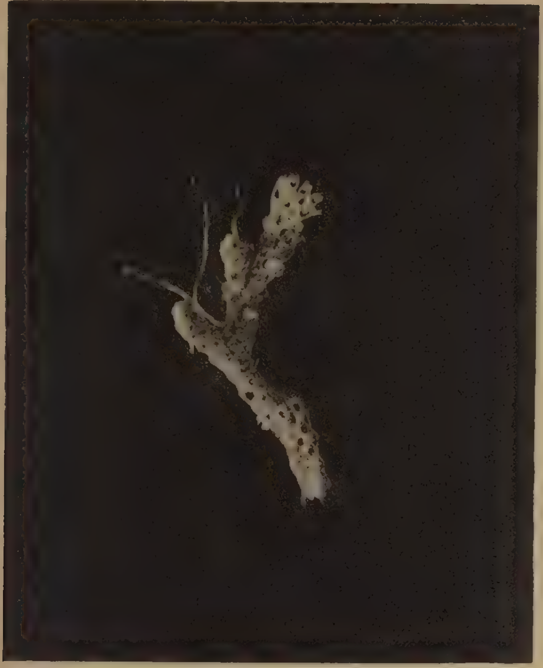
PLATE VII

Fig. 1. *Amastigia vibraculifera* sp.n. Part of type-specimen. St. WS 85, Falkland Islands. × *c.* 8. Note gigantic avicularia.

Fig. 2. *Cornucopina ovalis* sp.n. Type-specimen. St. 160, Shag Rocks. Natural size.

Fig. 3. *Cornucopina polymorpha* (Kluge). St. 175, South Shetland Islands. × $\frac{2}{3}$.



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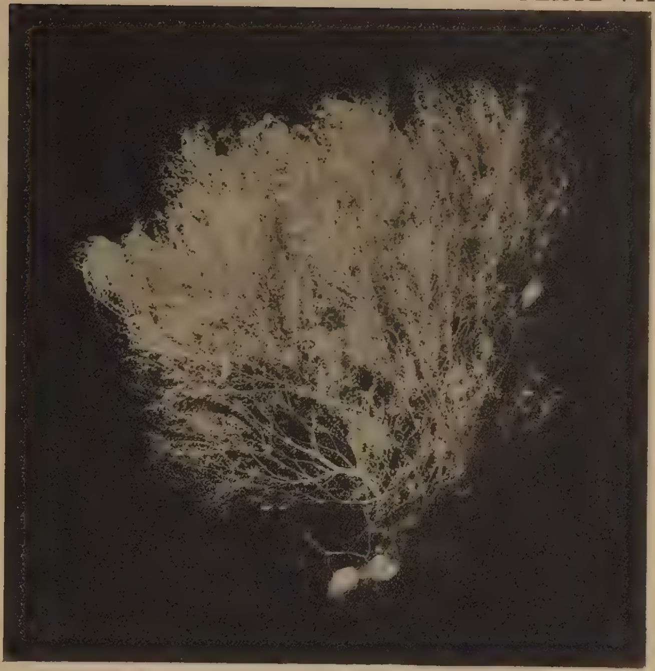

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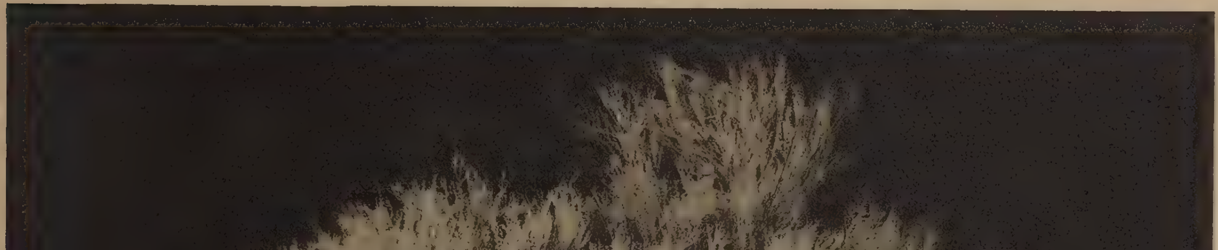

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PLATE VIII

Farciminellum antarcticum sp.n. St. TN 338, McMurdo Sound. Natural size. Note the groups of ovicells. The larger white specks are attached Foraminifera.

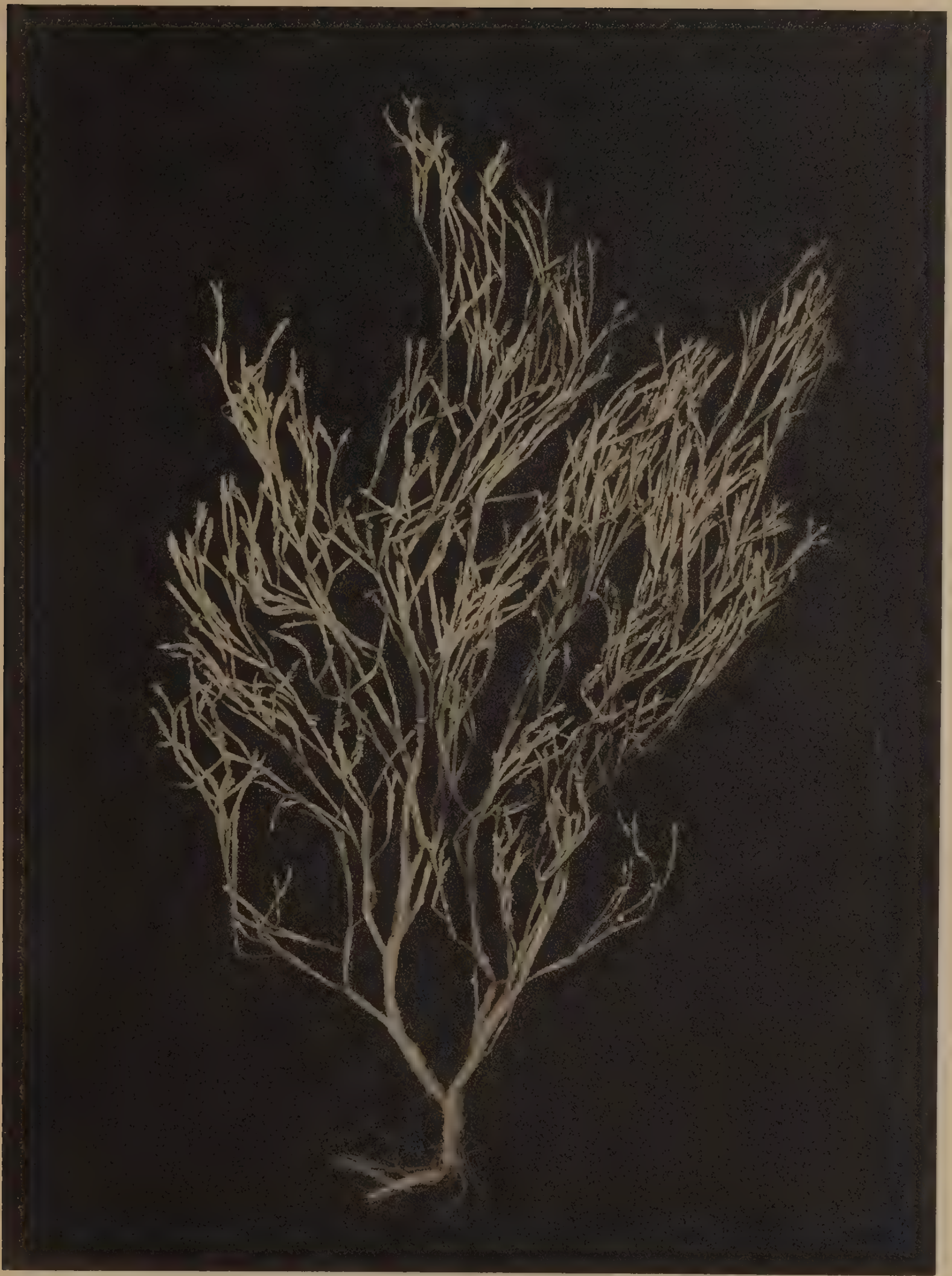


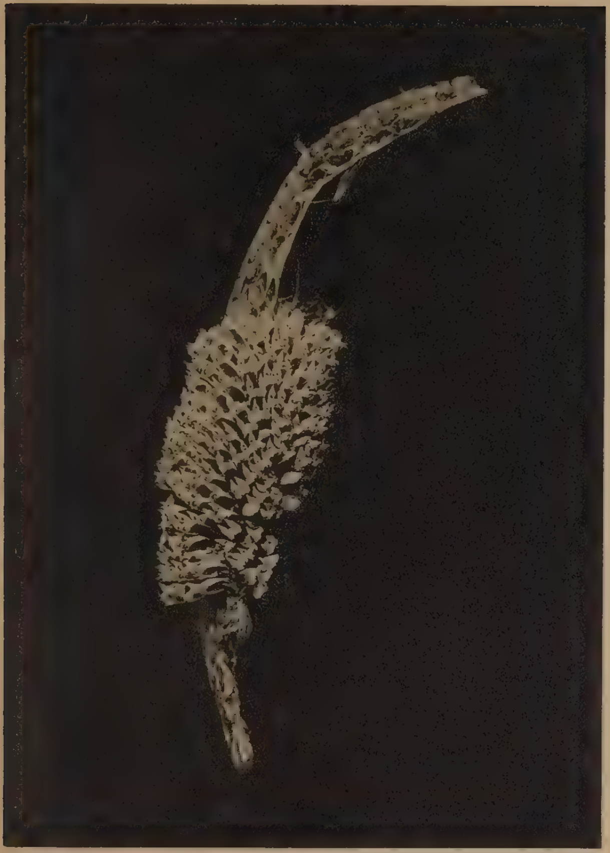
PLATE IX

Fig. 1. *Beania erecta* var. *livingstonei* var.n. St. TN 316, McMurdo Sound. × 4. A fertile zooecium is recognizable near the centre of the colony.

Fig. 2. *Beania erecta* Waters. St. 160, Shag Rocks. × 4.

Fig. 3. *Camptoplites retiformis* (Kluge). St. WS 42, South Georgia. Natural size. Zones of ovicells can be seen.

Fig. 4. *Camptoplites latus* var. *aspera* var.n. St. 45, South Georgia. Natural size.



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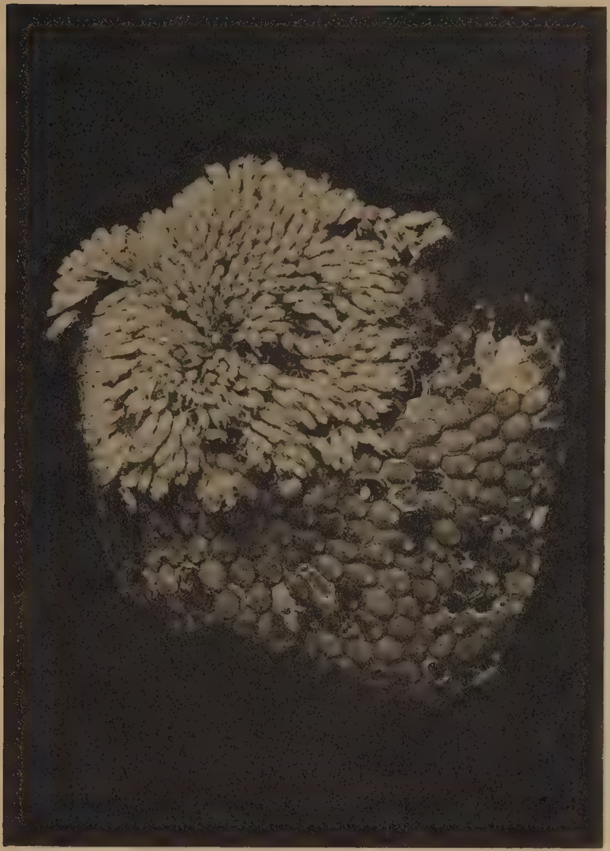

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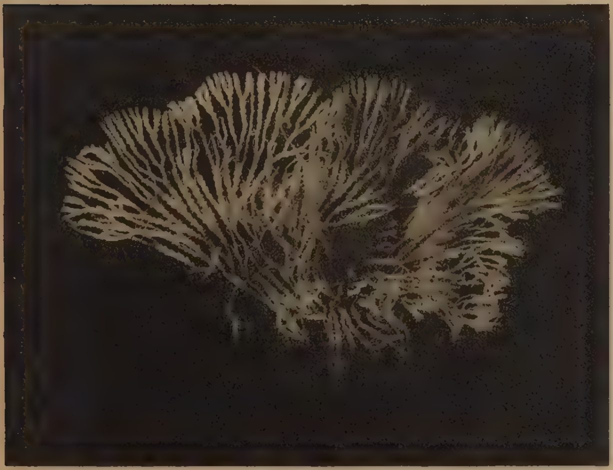

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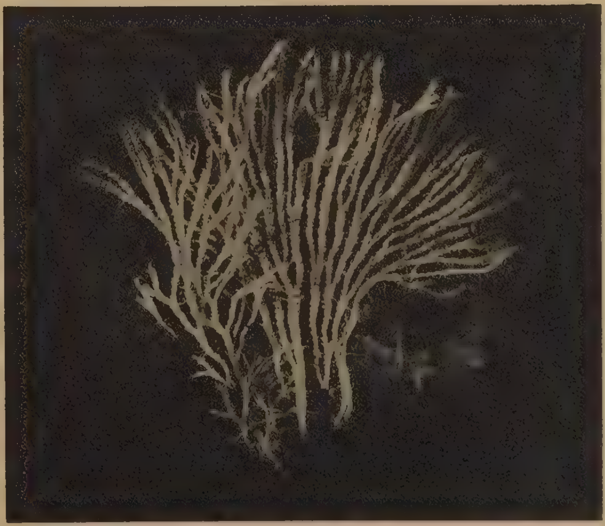

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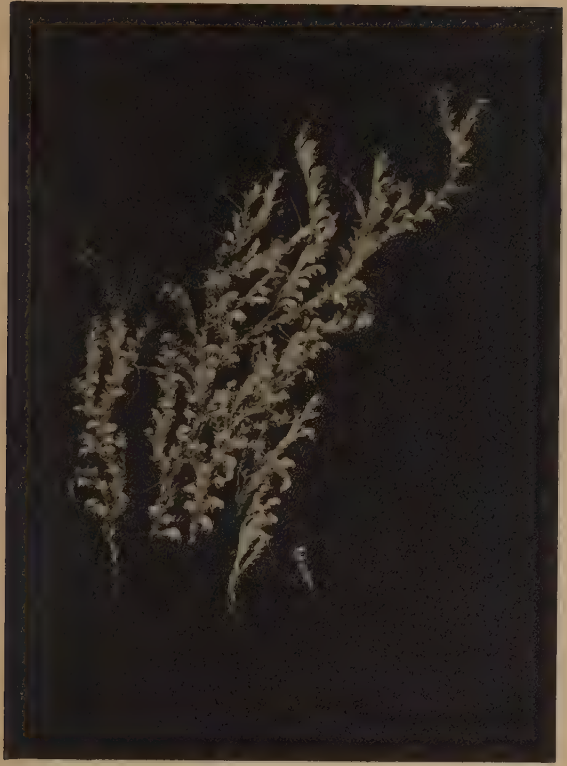
PLATE X

Fig. 1. *Camptoplites bicornis* var. *compacta* (Kluge). St. 1652, Ross Sea.

Fig. 2. *Camptoplites bicornis* var. *magna* (Kluge). St. 1652, Ross Sea.

Fig. 3. *Camptoplites bicornis* var. *quadriavicularis* var.n. Type-specimen. St. 160, Shag Rocks. Some of the larger avicularia, both long-headed and round-headed, are visible.

All figures ×*c.* 2.



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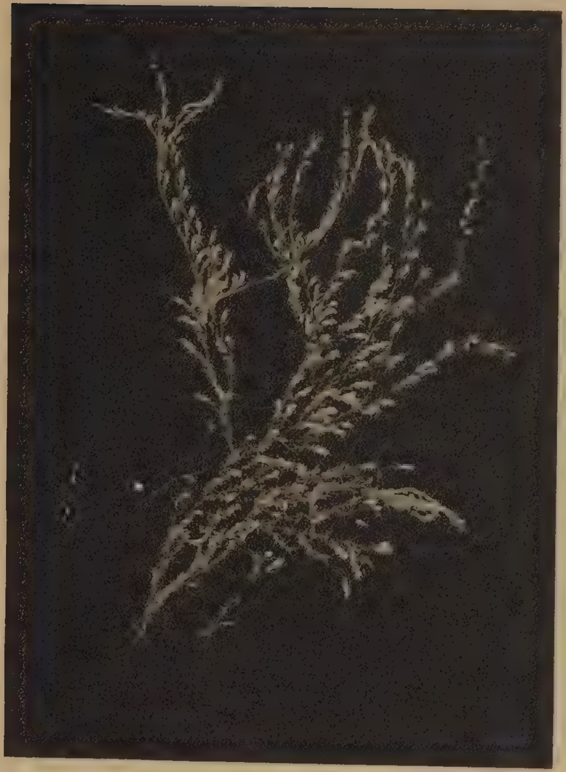

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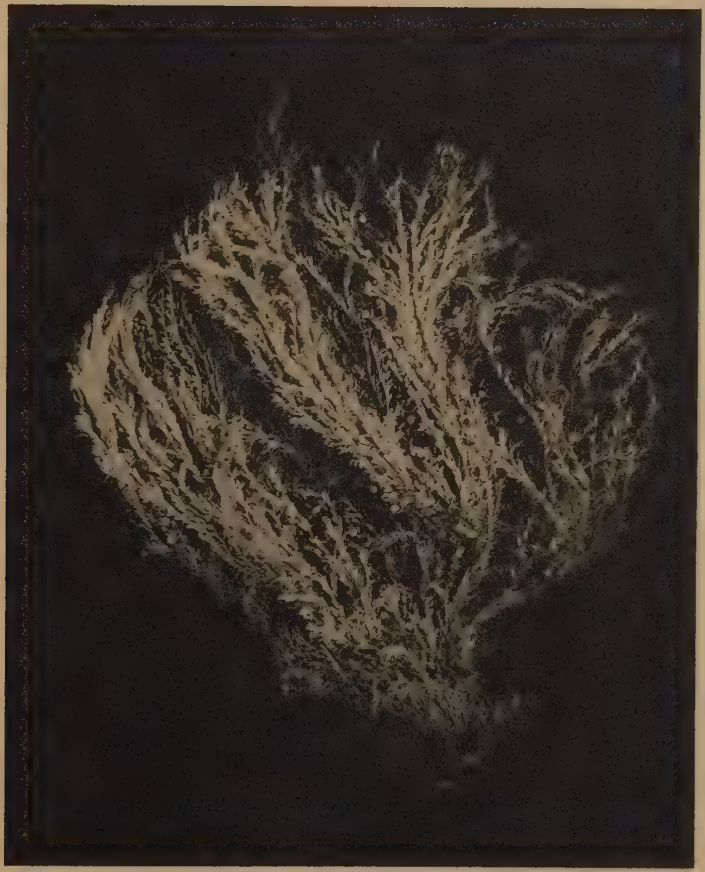

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PLATE XI

Fig. 1. *Camptoplites bicornis* var. *compacta* (Kluge). St. 1652, Ross Sea.

Fig. 2. *Camptoplites bicornis* var. *magna* (Kluge). St. 1652, Ross Sea.

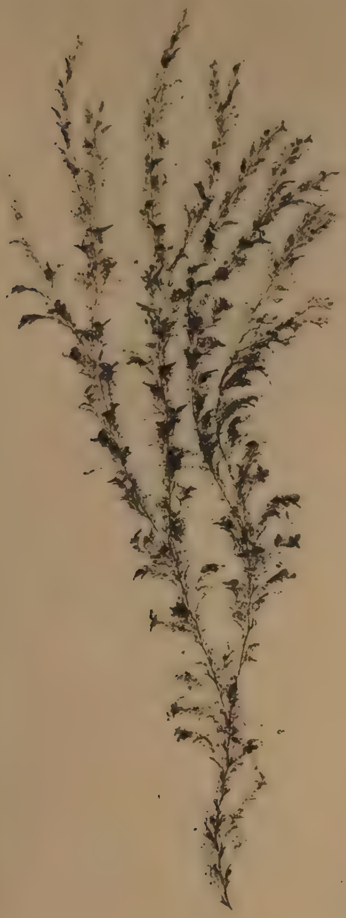
Fig. 3. *Camptoplites bicornis* var. *elatior* (Kluge). St. 1948, near Elephant Island. A secondary branch with rootlet is to be seen on the lowest branch on the left, and others on the next branch on the left and in some of the axils.

Fig. 4. *Camptoplites giganteus* (Kluge). St. WS 33, South Georgia. A main branch with two fan-shaped secondary branches.

Fig. 5. *Camptoplites lewaldi* (Kluge). St. 1652, Ross Sea. Specimen with few small secondary branches.

Fig. 6. *Camptoplites lewaldi* (Kluge). St. 1652, Ross Sea. Specimen with well-developed secondary branches.

All figures × 4; avicularia can be seen in each.



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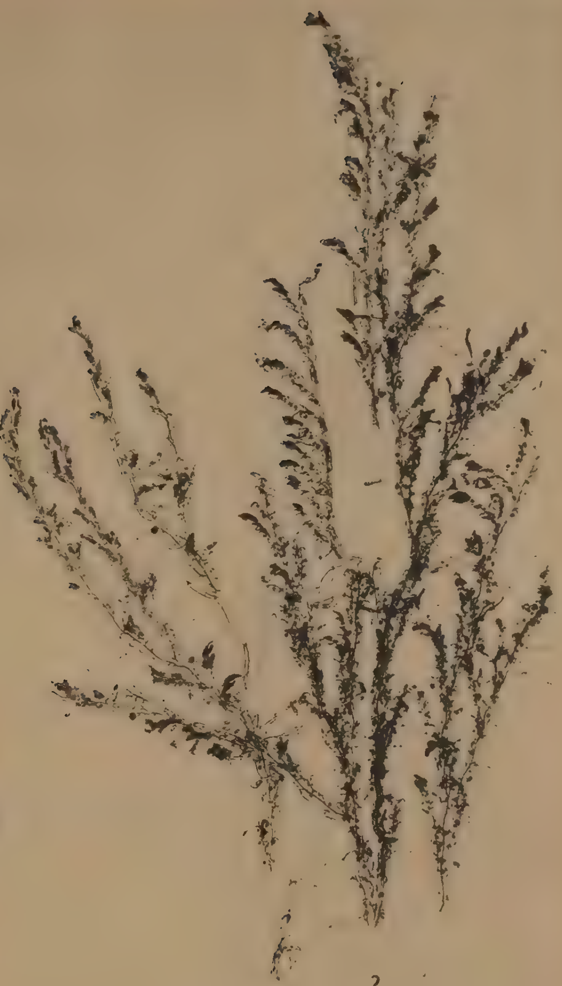

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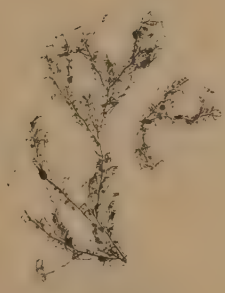

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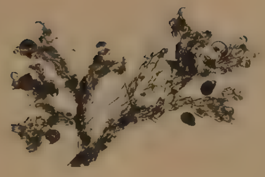

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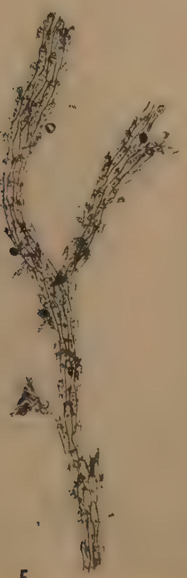

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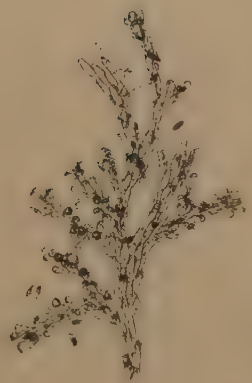

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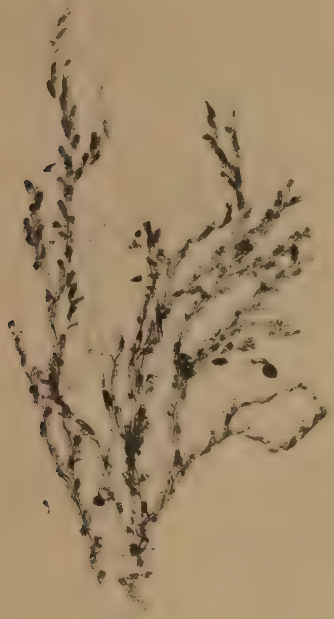
PLATE XII

Fig. 1. *Camptoplites bicornis* var. *quadriavicularis* var.n. Part of type specimen. St. 160, Shag Rocks. ×4. Secondary branches show best on the long left-hand branch which carries three on the part that is clear of the rest of the colony. Avicularia, both long-headed and round-headed, are visible in this figure and in figure 2.

Fig. 2. *Camptoplites bicornis* var. *quadriavicularis* var.n. St. WS 871, off Patagonian Shelf. ×3·8. Secondary branches show best at the right of the proximal end of the main piece, and on the detached piece to the left.

Fig. 3. *Camptoplites angustus* (Kluge). St. TN 340, Ross Sea. ×4. There is an axillary secondary branch in each axil.

Fig. 4. *Camptoplites rectilinearis* sp.n. St. TN 314, McMurdo Sound. ×4. Some ovicells are visible. Note that the two axillary rootlets project frontally.



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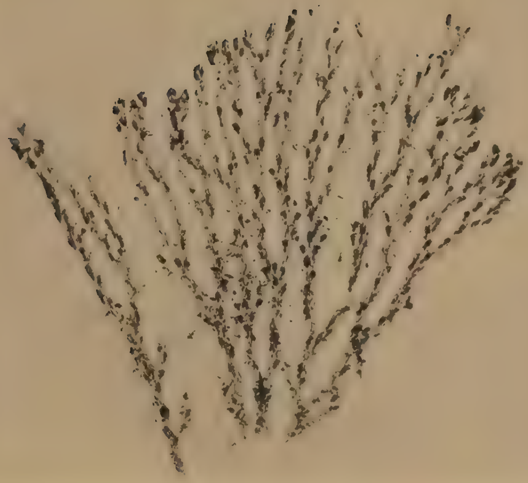

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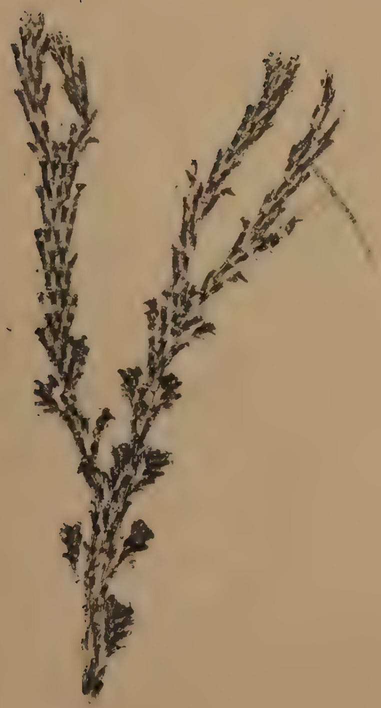

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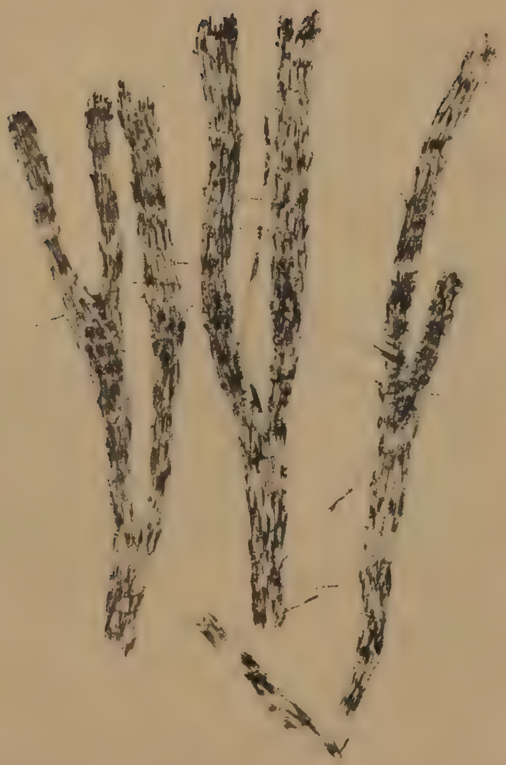

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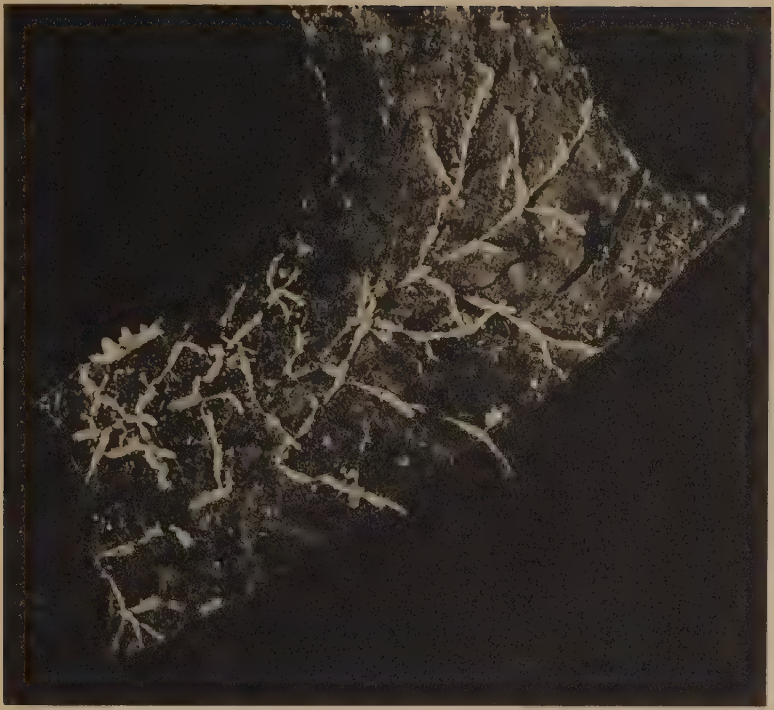
PLATE XIII

Fig. 1. *Aetea curta* Jullien. St. 1, Ascension Island. ×*c*. 9.

Fig. 2. *Aetea truncata* Landsborough. Type-specimen. 99.7.1.566. Arran. ×9.

Fig. 3. *Camptoplites tricornis* (Waters). St. 160, Shag Rocks. Natural size. A matted colony with many secondary branches.



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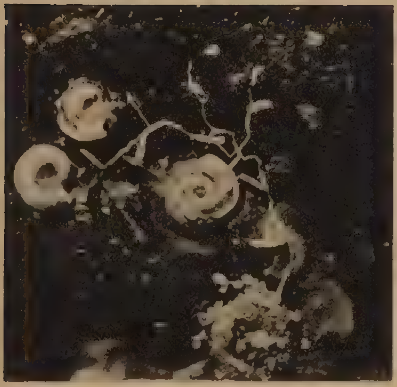

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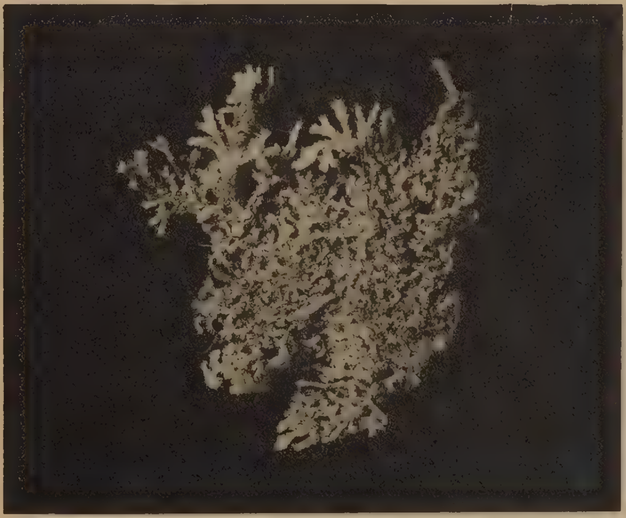

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